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DOING AWAY WITH THE LOAFING CHARGE
FIFTY MOTOR TRUCK OPINIONS

SCIENTIFIC AMERICAN

A Weekly Review of Progress in

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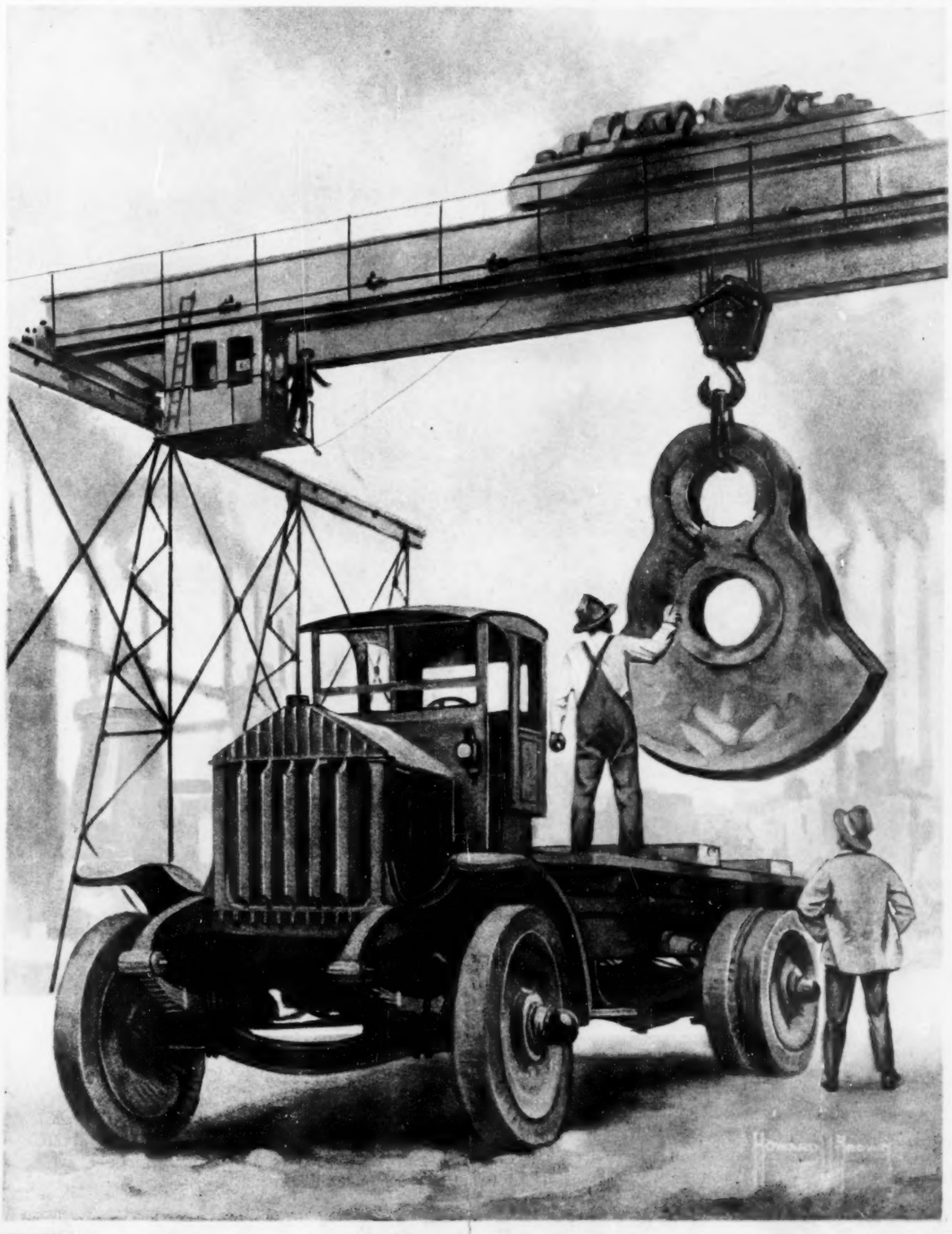

A VITAL LINK IN THE TRANSPORTATION SYSTEM OF THE NATION: THE MOTOR TRUCK

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SCIENTIFIC AMERICAN

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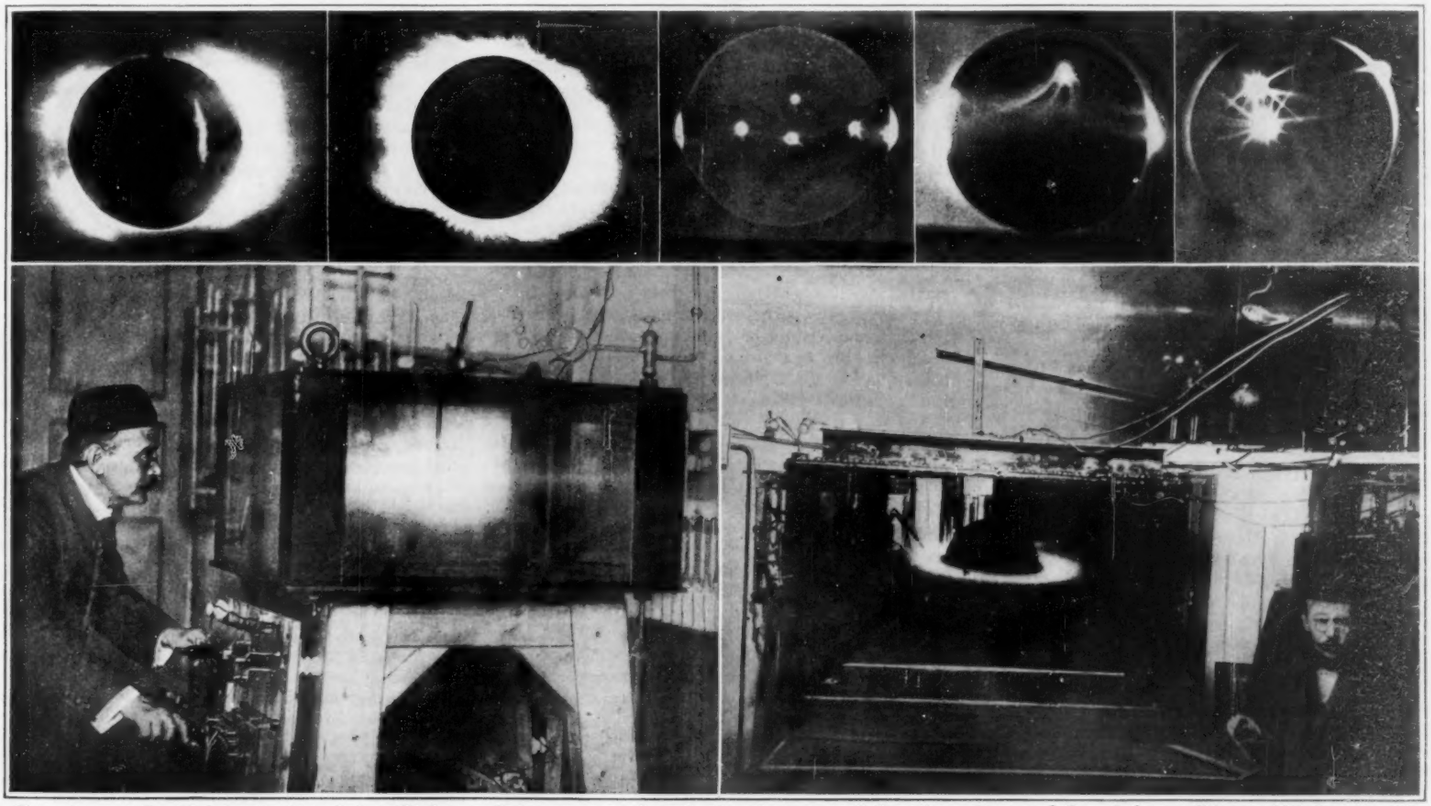

Two views of Dr. Birkeland's "terrella" outfit for producing on a small scale the phenomena of the solar system, and five of the conditions which he was able to create on his copper "planet"

The Solar System in Miniature

By M. Tevis

THE well-known Norwegian physicist, Birkeland, has recently devised an ingenious instrument for testing and demonstrating certain hypotheses of his with respect to the part played in our universe by electrical phenomena. It is now known that the sun is a powerful center of emission of electrons; these traverse space with a velocity approximate to that of light, and wherever they encounter rarefied gases they occasion luminous phenomena similar to those which can be observed within X-ray tubes. Dr. Russell, in his article, "The Heavens for February," in the SCIENTIFIC AMERICAN for Jan. 31, 1920, has told us something of these, and of the current theories which trace the magnificent aurora borealis to their effects.

Even if these electrons do not proceed from the sun to the various planets they are capable of being generated by solar light and especially by the ultra-violet rays wherever they strike against a material obstacle. While physicists are still in doubt with regard to many aspects of the matter, it is generally believed that electric phenomena are capable of shedding light upon the tails of comets, the aurora borealis, and the magnetic storms which in polar regions cause so much disturbance in the ordinarily constant direction of the needle of the compass.

It is such questions that Birkeland had in mind when he constructed his miniature universe. This consists of a huge bell jar having a capacity of 70 liters, into which various gases can be introduced and maintained at any desired degree of pressure. In the center of the jar is placed a "planet" 8 centimeters in diameter and called by the author the *terrella*. This is a copper sphere within whose interior is an electrical magnet capable of being excited by electric currents in such a manner as to reproduce upon the terrella the equivalent of terrestrial magnetism. On the side is a metal disk which generates electrons and which represents the sun.

By causing electric discharges to pass into the interior of the bell jar, luminous phenomena can be caused which undergo great variations according to the degree of rarefaction of the gas, the intensity of the discharge, and the degree of magnetization of the central globe. Birkeland first employed this apparatus in 1908 for the study of magnetic storms on the surface of the sun.

In the course of these experiments upon the zodiacal light the physicist made an interesting observation to the effect that upon actually diminishing the intensity of the current of discharge which traversed the apparatus the wide ring which represents zodiacal light contracts, and shades off so as to form around the equator of the terrella a corona similar to Saturn's system of rings and formed, like that, of several zones of different degrees of brilliance; it is even possible to recognize a dark space analogous to the division of Cassini.

These facts at once directed the investigator's ideas in a new direction. Saturn may be, like the sun, but to a less degree, a source of electrons; the latter, directed by the magnetism of the planet, produce in the rarefied gases which surround it a ring which is faintly luminous in itself, but which is also capable of reflecting the solar light toward the earth. This hypothesis frees us from many difficulties, since if we accept it we no longer have to explain the quasi-eternal equilibrium of material masses forming an ensemble so complicated and apparently so fragile as "Saturn's rings"; further, the acceptance of this theory involves the formulation of various others which lead us rather far. We should have to assume, to begin with, the magnetism of Saturn, of which we have no proof, but which is by no means impossible; above all we should have to explain how these rings of very rarefied gases are capable of being at once opaque, almost dark, and capable of reflection. We know it is true that the tails of comets diffuse solar light like the dust which glitters in a ray of light in a darkened room; but these wandering comet tails also give forth a light of their own and they are so highly transparent that the most remote stars can be seen through their substances. Finally, the rings revolve and this revolution would increase the gravitation. The French astronomer, L. Houllevigue, in criticising Birkeland's hypothesis, declares that it fails to take into account this fact. He believes further that it is best to hold at present with the accepted theory of Cassini while following with interest Birkeland's experiment. It would seem that this is the proper conservative viewpoint to take toward these startling innovations.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

World Hunger for Disarmament

IT was a happy thought in this season of peace and good will for the *New York World* to dispatch a message to leading men throughout the world, asking for their sentiments and opinions on the subject of disarmament. The replies reveal a practically unanimous and evidently very sincere desire on the part of civilization to get rid of the enormous financial war burdens which we are still carrying, in spite of the fact that a great world war for the vindication of justice and humanity was recently brought to a victorious conclusion.

It was at first sight illogical, but on second thought perfectly consistent that this questionnaire should have been sent out from the United States. It was illogical because our Navy Department is the one power which has an enormous program of warship construction in hand; it was fitting because, outside of the Secretary of the Navy and a small minority of naval officers, the Navy as a whole and the citizens of the United States as a whole believe that we should cut down rather than increase our naval appropriations, and that as a people we should take the lead in disarmament and the substitution of reasonableness and justice for the arbitrament of the sword.

It is in the nature of things that this appeal should find a more ready response among civilians than in naval and military circles; but we would remind the latter that the history of the two leading powers in the world today affords a notable case, in which an agreement for the discontinuance of armed protection was drawn up and put in force at the close of a bitter war in which they had been engaged. We refer to the war of 1812 and the agreement of the United States and Great Britain to set no fleets of fighting ships afloat upon the Great Lakes, and to limit their construction in these waters to one or two small gunboats designed purely for police and patrol duties. This momentous and extremely significant agreement was drawn up and signed over a century ago and has been most faithfully followed. Moreover, along the whole stretch of mutual frontier, reaching for over 3,000 miles, there has not been erected during the intervening century a single fortification.

Nobody, of course, demands that any such sweeping elimination of warships should be made upon the high seas. The policing of the seas and the keeping open of the trade routes call for the maintenance of fleets, whose relative strength should be drawn up after a careful and friendly consideration of the relative responsibilities and liabilities of the two nations—a delicate and difficult problem, but one that is entirely possible of solution if the representatives of the two powers gather together in a spirit of mutual confidence and fair play. In the one case we have an inland empire, self-contained and so strong in population, wealth and natural resources that it is unconquerable by any conceivable hostile combination. In the other case we have an island empire that is scattered over every quarter of the globe, and whose very existence depends upon the freedom of the seas and the maintenance of the highways of commerce, so that her ships and those of the nations of the world may come and go as they please.

It such a happy solution of the problem was so quickly found at the close of a bitter war between the two countries, it should certainly be possible to find an equally happy solution at the close of the late war for civilization, in which the two countries fought side by side as loyal and mutually appreciative allies. It is the belief of all thoughtful Americans that our beloved country stands just now at the parting of the ways. The fortunes of war have left us in a commanding position, and with an influence in international affairs which not even the most sanguine among us believed would be ours for many a decade to come. Upon the use which we make of this heritage depends to an immeasurable extent the future peace and happiness of the great world of which we form a part. If our statesmen are guided by the spirit of Washington and the spirit shown by his worthy successors in the ever-memorable agreement as to armaments on the Great Lakes, they will have the opportunity, during the next few years, to write some of the most glorious and honorable chapters in the history of this country.

A Neglected Transportation Facility

IF it were not for the inertia of habit and tradition, that most admirable method of transportation known as the moving platform would be today one of our recognized and most effective means of transportation. Its neglect is not due to the fact that we know nothing about it in a practical way, for nearly thirty years ago a moving platform formed one of the notable exhibits at the World's Fair, Chicago, where it carried multitudes of people without any mishap.

Fundamentally, the difference between a moving platform and a train of cars is that in the first case the wheels are attached to the car and move with it, and in the second the wheels are attached to Mother Earth and the cars move over them.

And why not?

Habit, it is true, tradition, custom, the immemorial habit of "passing the buck" and all sorts of other human inhibitions cry out against such an unheard-of thing as taking the wheels off the cars and bolting them to the track. But we are already doing this in that most brilliant device for transporting freight, known as the belt conveyor; and if the conveyor is so efficient in carrying wheat, coal and miscellaneous freight, why should it not show the same efficiency in the carriage of people?

For the moving platform is neither more nor less than an endless conveyor belt for the transportation of people in bulk, and on a scale that is not approached by any other system of transportation.

As the more mature among our readers will remember, we commenced to advocate the moving platform many, many years ago, and we are gratified to note that Mr. Turner, the chief engineer of the Transit Construction Committee, in his recent report of future extensions of our subway system, puts in a strong plea for the moving platform. In showing the superior advantages for crosstown service of moving platforms over shuttle service, it is sufficient to state that whereas the horrible shuttle service in the subway between Grand Central Station and Times Square has a maximum capacity of, say, 10,000 people per hour, a platform running at three, six and nine miles an hour could handle over 30,000 passengers per hour each way.

In his study of the subject, Mr. Turner has set forth the advantages of moving platforms over shuttle trains as follows: There will be but one long walk instead of two at transfer points, no period of waiting and no congestion on platforms; there will be a saving of time in transfers, a tripling of the passenger capacity and a seat for every passenger.

The great carrying capacity of moving platforms is due to two facts: first, that they move continuously, without any stops, at a speed of nine miles an hour; and secondly, that there would be stations at every block instead of one at intervals of from five to ten blocks. A platform next to the stationary platform moves at only three miles per hour, an intermediate platform at six miles per hour, and a third platform, upon which are the seats, at nine miles per hour. Therefore, the enormous capacity of this system is due to the fact that the passenger can board and leave the platform at any street corner without delays due to stopping or crowd congestion.

Railroad Electrification in the Rocky Mountains

IT is well understood that the economics of the substitution of electricity for steam traction are intimately related to the topographical and other conditions where the proposed change is to be made. Also it has been proved that nowhere does electrical haulage show its superiority over steam so markedly as on the steep grades of the mountain divisions of our railroads, particularly if the stretch of track to be electrified is within the economical transmission radius of hydro-electric power plants.

The most important development of this character is the electrification of the lines of the Chicago, Milwaukee and St. Paul Railway between Harlow Town and Avery, where they cross the American Continental Divide. From the engineers' and the operators' standpoints, this is an unusually heavy division, since three mountain ranges have to be crossed whose successive elevations are 4,150, 6,322 and 5,788 feet. There are over twenty miles of two per cent grade and a maximum curvature of ten degrees on this division. The total length is 438 miles. These figures, better than anything else, give an idea of the heavy duty required of the electrical service in hauling the heaviest freight and passenger trains to and fro over the Rockies in this locality.

So successful has been the installation that it was decided to make a similar change where the tracks of this railroad cross the lower but still very formidable divide of the Cascade range. This stretch of line is something less than one-half the length of the Rocky Mountain crossing, and the two summit elevations are less than one-half those in the Rockies. On the other hand, there is nearly twenty miles of 2.2 per cent grade against the westward traffic. It was opened during the past year, with the result that there is now 647 miles of main line and another 200 miles of sidings and other tracks, making a total of over 850 miles of track that has been changed from steam to electric traction. Great credit is due to the company for the enterprise which it has shown in putting through this great transformation.

The problem of the electrification of tracks which run through fairly level and what might be called easy country is represented by the electrified sections of the New York Central and the New York, New Haven and Hartford Railroads, the one using direct current and the New Haven, the alternating current. In the interests of the art, it is to be regretted that there has not been any definite statement made public as to the relative cost on these two roads of electric and steam traction. It is true that the installations were made more as a matter of necessity and convenience than with the expectation that there would be any considerable reduction of costs. The change at the Grand Central Terminal was due to the pressure of the law, coupled with the conviction on the part of the New York Central Company that the change from steam to electricity would make possible a great saving in train movements, to say nothing of the possibility of putting the train yard below street level and building the present magnificent terminal, undoubtedly the finest work of its kind in existence and a lasting tribute to Colonel Wilgus, the engineer in charge of the work. We do not know whether the two companies have kept any separate account of the operating costs in the terminal, as distinguished from those of the electrified sections of their main lines. The New York Central electric zone extends thirty miles and the New Haven line for about seventy-five miles from this city.

Most valuable figures have been published regarding the Chicago, Milwaukee and St. Paul Division with instructive comparisons of steam and electric costs; but so far as the two eastern roads are concerned, we believe that no official comparative statement has been made public. In the absence of any such, the public will inevitably presume that here at least electric traction has not shown a similar economy over steam.

The greatly increased cost of fuel, both coal and oil, should stimulate the railroads of the United States to a new study of the problem of electrification. Because the change from steam to electricity showed no corresponding profits and possibly a loss a dozen or fifteen years ago, it does not follow that it would not be profitable today.

Electricity

A Heater That Is Proof Against Fire.—For guarding against danger of fire or scorching, a new heater is being brought out by an American company with certain safety features. An automatic gravity switch is mounted in the base of the heater, and when the latter tips over, face down, the switch disconnects the circuit. When the heater is righted the current is automatically turned on again. The bowl is also so hinged that it cannot be tipped down far enough for the heat rays to strike the floor. The heater, it will be understood, is of the concentrated, reflector type.

Machine for Winding Lamp Filaments.—From a recent issue of *Electrical World* we learn that a machine for automatically winding or concentrating coils used in nitrogen, gas-filled and miniature lamps has been designed by Charles Eisler of Newark, N. J. This machine is designed to wind 15-watt to 1,000-watt coils of 25 to 900 turns per inch with a core from 0.003 inch to 0.035 inch. The speed is from 500 to 3,000 revolutions per minute, depending on the size of wire. The wire can be heated electrically to a cherry red while being wound. It is possible to coil about 5,000 feet of wire in one length, the amount varying with the size of the wire.

Asbestos-Covered Magnet Wire.—In the usual burnouts of solenoids and motor windings it is the insulation only that is burned; the metal generally remains intact. So it is interesting to note that a manufacturer has introduced asbestos-covered magnet wire which should go a long way toward reducing the probability of burn-outs in electrical devices of various kinds. The new wire is intended for armature coils in particular and is said to have high dielectric qualities. It is proof against moisture, fire, acid and oil. The coating of asbestos is treated with compound in such a fashion that it resembles rawhide. It is claimed that the wire is practically immune to hammer blows and that the conductor can be deformed without damaging the insulation.

Insulated Tools for Electric Railways. — The introduction of the third rail on electric railways has rendered it difficult to carry on certain repairs on the rails and road bed. Great care must be taken in order that tools will not come in contact with the live rail, and this is by no means a simple matter where common labor is a factor. Several methods have been tried to insulate the tools, such as winding insulating tape about metal parts of tools or using rubber sleeves, but these fail either in the electrical or mechanical sense. From England comes a worthy solution of the insulated tool problem, in the form of special tools which are divided and insulated into short sections. These sections are such that it becomes impossible to span the distance between third rail and regular rail, in an electrical sense. At the same time the strength of the insulated tools is practically that of the uninsulated tools.

Submarine Cable Transmission. — A recent paper published by the *Journal* of the Franklin Institute deals with the experiments of Frederick E. Pernot in an attempt to develop a method of signal transmission over submarine cables which would permit of a more effective use of existing cable systems. By this scheme signals are transmitted by means of alternating currents simultaneously with the normal battery, or direct-current, operation of the cable. Currents of several different frequencies may be used, reserving a given frequency for each message, and by tuning or equivalent methods at the receiving end these messages may be separated, so that the simultaneous transmission of a number of messages is rendered possible. Actual trial of the proposed alternating-current method was made covering distances up to approximately 700 kilometers with results which are said to be completely satisfactory.

The Longest Land Line in the United States was recently opened to the public by the Western Union Telegraph Company, giving direct communication between New York and Seattle. The circuit is of the "printer" type, the operator at each end punching a tape by means of a keyboard for transmitting purposes, while an automatic typewriter receiver takes down the incoming messages in finished form. Throughout the 3,381 miles of the New York-Seattle circuit there are no manual relays, mechanical repeaters being used to handle the messages through the various circuits comprising the line. Four messages simultaneously each way can be sent over the single copper strand, which is grounded at each end, or something like 225 messages each way per hour. The cost of the copper for the wire is estimated at a little more than $125,000. The cost of construction, including labor and material, runs approximately $70 per mile.

Astronomy

The American Association of Variable Star Observers now has a membership of 69, and during the past year made more than 9,000 observations on 395 stars. During the years 1912 to 1920, inclusive, the total number of observations amounted to 109,294.

Radial Velocity of Nova Cygni. — The radial velocity of Nova Cygni No. 3 was determined by Messrs. Adams and Joy from the H and K lines on 15 spectrograms to be 18 kilometers a second. As the component of solar motion in the direction of the star is 18 kilometers a second, the star has probably no appreciable velocity relative to the stars in general.

Mrs. Fiametta Wilson, a leading English observer of meteors, died July 21, 1920. Just before her death she had been selected by Harvard College Observatory to receive the first "Edward C. Pickering Astronomical Fellowship for Women." This has now been assigned to her colleague in meteor observations, Miss A. Grace Cook, F. R. A. S.

The Circulation of Calcium About Sunspots has been studied by Mr. Philip Fox on a series of spectroheliograms made with the Rumford spectroheliograph of the Yerkes Observatory in the years 1903 to 1908. The direction of motion around single spots seems to be definitely anticyclonic for both hemispheres and in both high and low latitudes. The motion about bipolar spots is cyclonic for the leader and anticyclonic for the trailer.

Map of the Sunspot Spectrum. — The Mount Wilson Observatory has just published a large photographic map of the sunspot spectrum, covering the region between wave-lengths 3,900 and 6,600. The negatives from which the map was made were taken wit hthe 75-foot spectrograph used with the 150-foot tower telescope, and were enlarged to a scale of one centimeter to the angstrom, in order to show the separation of the lines caused by the magnetic field of the sunspot.

One Hundred New Spectroscopic Binaries.—The Dominion Astrophysical Observatory has published a list of the first 100 spectroscopic binaries discovered at Victoria since the work was begun there in May, 1918. The variable velocity of these stars in the line of sight—the indication of their binary character—was discovered in the course of observing radial velocities of 576 stars between the 5th and 10th magnitudes, in accordance with the program of such observations carried on in coöperation with the Mount Wilson Observatory.

Records of Double Stars.—Mr. S. G. Barton, in a notice of the late Prof. Eric Doolittle, director of Flower Observatory, tells us how S. W. Burnham, the world's leading authority on double stars, turned over his library and manuscripts to Doolittle in 1913, and how the latter had since been gathering a vast fund of material toward a supplement to Burnham's "General Catalogue," published in 1906. In accordance with Professor Doolittle's wishes, the continuation and eventual publication of this work has been entrusted to Dr. R. G. Aiken, of the Lick Observatory.

Karl Herman Struve, director of the Berlin-Babelsberg Observatory, died August 12, 1920, at the age of 66. He was born at Pulkova, Russia, where his father, Otto Struve, was director of the observatory. His grandfather was the equally celebrated astronomer F. G. W. Struve. All three representatives of the family were gold medalists of the Royal Astronomical Society, of England. The last Struve's earliest and most important astronomical work was done at Pulkova. He became professor of astronomy and director of the observatory at Königsberg in 1895, and succeeded Foerster as director of the Berlin-Babelsberg Observatory in 1904.

The American Astronomical Society held its 24th meeting September 1-4, 1920, at Smith College, Northampton, and Mount Holyoke College, South Hadley, Mass., both colleges for women. The directors of the observatories of the two institutions are, respectively, Miss Harriet W. Bigelow and Miss Anne S. Young. According to its constitution, the society may elect one honorary member at each annual meeting, and Sir F. W. Dyson, the British astronomer royal, was thus honored at the meeting above mentioned. The relations of the society to the National Research Council are such that the society controls the American Section of the International Astronomical Union, which is expected to meet shortly before each of the triennial meetings of the international organization. The next of these will be held in 1922. The executive committee of the American Section now comprises W. W. Campbell, chairman; W. S. Eichelberger, H. N. Russell, Frank Schlesinger, and Joel Stebbins, secretary.

Engineering

A Coating of Magnesia Cement on the timbers of mines is stated to be an economical and efficient assurance against fire, especially in the arid regions where timber becomes highly inflammable and is difficult to replace. It is elastic, adheres firmly to almost any surface, and is stable and durable.

Benjamin Holt, of caterpillar fame, died early in December. Mr. Holt was the inventor of the machine that bears his name, and the one from which it is generally understood that the British army engineers got the immediate inspiration for the tank. While the track-layer more than most inventions was anticipated in more or less completeness by numerous early inventors, it is equally true that the work of these pioneers to an unusual extent died with them; and Holt is recognized as responsible for the appearance of this principle in modern tractor engineering.

The Mechanical Side of Turbo-Generators. — It is said that one pound of material in the present 5,000-kw. turbo sets does the work required of five pounds in the first 5,000-kw. set built in this country, according to *General Electric Review*. Stator construction has reduced itself to the simplest form as the requirements of rigidity, light weight and flexibility are best fulfilled by such a design. However, high speeds and increased capacities have introduced real difficulties in the construction of rotors. The centrifugal stresses have necessitated the use of a solid forged rotor, and in the largest machines it has been desirable to use a three-piece rotor because of the great length and weight of a solid one-piece forging. Ventilation, which is of prime importance in the modern turbo-generator, is also receiving careful attention on the part of engineers and designers.

The Color of Cypress.—Southern bald cypress is about the most variable in color of any of our native woods, and in different localities is known as red cypress, yellow cypress, white cypress and black cypress. There is a rather prevalent belief that cypress with dark colored heartwood is the most durable, but the opinion of the U. S. Forest Products Laboratory is that as far as durability is concerned, the color of the wood makes very little difference. In service records obtained by the laboratory, any difference in the length of service of red cypress and yellow cypress appears to be due entirely to a difference in the amount of sapwood in the timbers. Cypress trees with light-colored heartwood usually have more sapwood than those with dark colored heartwood, and sapwood is not resistant to decay. The important thing if durability is desired appears to be to select the heartwood of cypress regardless of its shade.

Light Weight Construction for Light Loads.—Does it not seem uneconomical to design a floor construction which weighs nearly as much as the load it supports? Yet this is what must be done with many types of fireproof construction to support loads such as occur in apartment houses, schools, hotels, office buildings, and so on. A great part of the materials of construction is thus used to support itself. Thus a steel company directs attention to its light-weight pressed steel beam which has been introduced for light-occupancy buildings. The beam is light in weight and correspondingly easy to handle—one man can carry this beam about without undue strain—while only a minimum of materials is required for the floor and the ceiling. All members of this light beam construction are shop fabricated, saving field work, and it is only necessary to set the beams in place, attach metal lath and apply plaster and concrete. No centering nor forms are required.

Pre-Cast Concrete Roof Trusses.—Reinforced concrete was substituted for steel in the construction of the shed on Pier No. 6 at Cristobal, Canal Zone, at a time when steel deliveries were uncertain and the cost of steel high. Pre-cast concrete trusses were used for the roof with marked success and economy, we learn from *The Technical Review*. The shed in question is 945 feet long and 159 feet wide. It has a clear height under the trusses of 25 feet. Each truss is composed of 3½ cubic yards of concrete, contains 1,000 pounds of steel reinforcement, and weighs about 8 tons. The cross trusses are about 39 feet in length, 7 feet in depth, and extend from column to column. Each contains 8½ cubic yards of concrete, 4,000 pounds of steel reinforcement, and weighs 19 tons. The entire pier is covered with a roof slab 3½ inches thick, which might advisably have been made thicker to minimize deflection and tension cracks. Owing to the absence of wind, snow and ice loads, a live load of only 10 pounds per square foot was used in designing the roof.

Doing Away with the Loafing Charge

Loading and Unloading Apparatus that Helps to Keep the Truck Always Productively Engaged

By Victor W. Pagé, M.S.A.E.

THERE are a number of conditions which must be taken into consideration if one is to operate one truck or a fleet of trucks economically. We have previously considered in these columns the importance of systematic maintenance and lubrication. The evils of over-loading have also been considered and considerable space has been devoted to the use of trailers as a means of increasing the hauling capacity of the motor truck.

There are a large number of items entering into the cost of operation, some of which can be taken care of by careful mechanical supervision, adequate lubrication and careful driving. There is one big item, however, that is usually beyond the control of the driver or those responsible for maintenance. This is the idle time of the truck, which helps to determine the actual operating costs. This depends on a number of factors, some of which can be controlled by proper mechanical supervision, while others call for executive consideration and direction. For lost time due to waste labor in loading or unloading the truck on account of the failure to provide the proper mechanical appliances to facilitate the work, no one is to blame but the truck owner or the executive directing the use of the trucks.

An excellent example of a body designed for a specific purpose. It permits the carrying of the maximum number of empty barrels

Whenever it is necessary to load heavy or loose material into trucks, it takes considerable thought to devise means to keep the time down. The time required for loading is said to be a more serious matter than that of unloading in handling many materials, so motor truck builders and those using them are trying to reduce this operation by the construction of ingenious special bodies and various loading devices.

Bulky materials of large size—such as baled hay and cotton, barrels, furniture, boxes and crates—are very easily handled because they can be moved from the loading platform directly to the body or platform of the truck and stowed away with comparative ease by the driver and his helper or by laborers employed for that specific purpose. Where a large variety of freight is handled, composed of parcels that differ greatly in size and weight, such as in furniture moving and in the express business, it is necessary to rely mainly on roustabouts for handling them. Materials with some degree of uniformity in size, such as gravel, road metal, ashes, dirt and coal and any other substance that is usually stowed in piles presents a problem that may be solved easily by using mechanical loaders.

In some cases scoop or bucket loaders operated by conveyor machinery greatly reduce the cost of loading a truck. As an example of how these mechanical devices cut down idle time, we are told that a certain amount of coal that required the labor of several hand shovelers for twenty minutes was loaded by one shoveler and a mechanical loader in about three minutes. It has been estimated that in transferring crushed stone from the ground to a motor truck body the cost of hand shovelers is about twenty cents per cubic yard. With a mechanical loader the same amount of work can be accomplished at a cost of two and a half cents per cubic yard. In contracting work a steam shovel, which can dump its load directly into the motor truck body, will do the loading at even less cost than the figures mentioned so that the great advantage of machinery over hand labor is apparent.

In certain lines of business where a large number of small packages are carried that do not vary much in size, as in department store deliveries, the removable rack system is an important method of reducing the cost of both loading and unloading. Such racks are extremely valuable in moving goods from a warehouse to retail stores or from the main delivery stations to branch stations in outlying districts where lighter trucks or delivery wagons can handle the distribution to the individual consumer. Such racks are really special, but simply constructed bodies provided with sturdy truck caster wheels.

If heavy material is to be handled, such as paving blocks, bricks, boxes of canned goods, castings, etc., it is to be expected that the rack must be much more substantial in construction and be fitted with wheels adapted to run on light rails so the loaded rack can be easily moved from the loading platform to the truck chassis. The method of keeping the rack in place after it has been put on the body can be worked out by a number of simple expedients, such as rods on each side of the chassis provided with quick action clamps or turn-buckles that will engage hooks on the body sides.

When light goods are handled the rack may be lifted into the body of any ordinary delivery wagon. In many department stores the delivery of the parcels is made easier by using large fiber containers or wicker baskets, roughly about four feet wide by six feet long by four feet in depth. These are provided with wheels at the bottom so that they can be readily moved from the packing room to the loading platform and from that point to the truck body. It is the custom in the packing room to arrange the distributing so that each basket or group of containers represents a different delivery district. While the truck is in motion the helper usually sorts the packages so that they can be delivered in routine order when the district in which the delivery work is to be done is reached.

If a truck is designed for handling heavy material, it is a great advantage to provide a davit on the side from which a chain hoist may be suspended so that heavy packages, barrels, castings, etc., may be easily lifted into the main body. Quite a number of trucks built for special duty work are provided with winches mounted on the truck body platform at the front and just back of the driver's seat or at the rear end of the chassis. While some of these winches are operated by hand cranks and reduction gearing, most of them are operated from the engine. An excellent example of the practical use of a winch or windlass is on those trucks used for moving safes and pianos. In this case the truck power plant not only furnishes the energy for transporting the heavy load, but through the medium of the engine-driven winch, it furnishes power enough to unload it from

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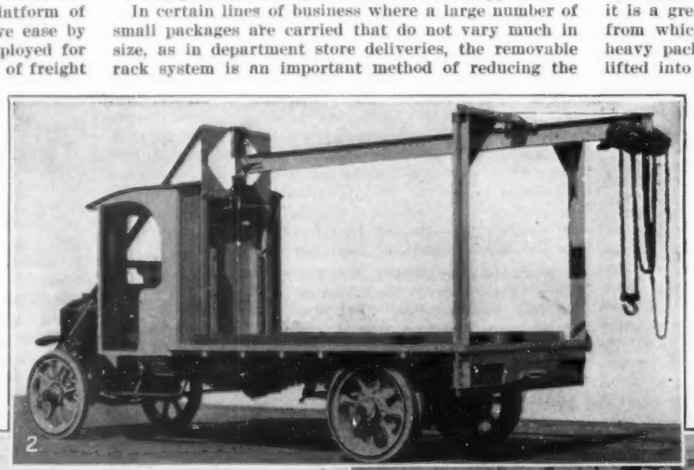

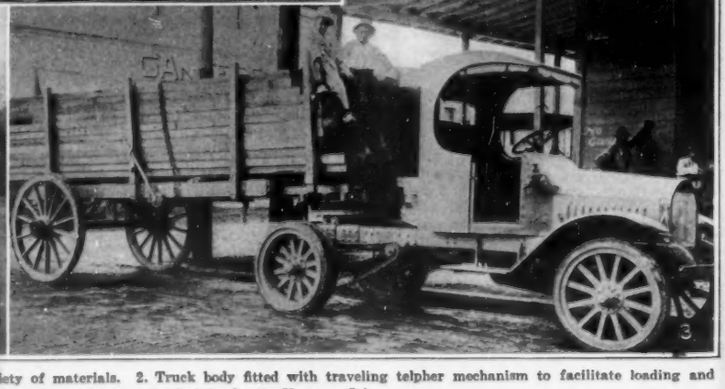

1. The standard type of dumping body with hydraulic hoist, a quick way of unloading a large variety of materials. 2. Truck body fitted with traveling telpher mechanism to facilitate loading and unloading heavy material. 3. Truck and trailer outfit used for hauling finished lumber in Havana, Cuba

Some of the means at the disposal of the truck owner who seeks greater utilization of his trucks by cutting the time spent in loading and unloading

Aircraft for Pleasure

By Bertram W. Williams

IF the history of the automobile is to be repeated, the airplane must first prove itself to be a reliable and efficient instrument of pleasure before it can hope to be a commercial success. The business man by the very nature of things must be cautious in experimenting with new and practically unproven methods. It has taken years to impress upon the public that the air is as safe a route of travel as any other provided proper machines and precautions are used, apart from it being infinitely more swift and comfortable. It now remains to convince commercial interests that the airplane is an economical means of transportation.

The success of aircraft in the war, far from advancing the cause of civilian aviation, has really made the average business man to be somewhat suspicious of its use as a substitute or even auxiliary of the proven automobile and truck. This idea has not been corrected by the daily press, which still persists in regarding all kinds of flying machines as dangerous and expensive toys. To combat this theory it is essential that the public be educated to look upon flying as nothing out of the ordinary—neither a hazardous nor very costly occupation. When that is accomplished, the vast field of its uses in the future will soon be realized.

In the past, manufacturers have given little attention to the general public as a possible customer; they have rather concentrated on Government and War Office orders, where excessive power has been the dominating need, and cost of construction and economy of upkeep neglible factors. Once the aircraft industry devotes its time to making these two latter details their chief consideration, flying will soon become as common as motoring.

The automobile was for a long time dependent on good roads before it became popular with the general public, but if present-day machines were only capable of traveling on paved highways, they would still be a comparative rarety in this country, where four-fifths of the roads are far from ideal. Just so must the airplane be made more or less independent of large and specially prepared landing fields.

One of the chief exhibits at the San Francisco aircraft exposition, held some time ago, was a small machine built solely for pleasure purposes by the Longhead organization of Santa Barbara, and there are so many novel and interesting features about this miniature airplane that it is worth describing in detail. The "S-1," as it is called, is a single-seater biplane with a wing span of 20 feet, and a total weight empty of only 400 pounds. Everything about this little airplane denotes a refinement and finish worthy of the best French and English machines, and lacking, it must be confessed, in most of our domestic craft. The fuselage is of the monocoque type, consisting of a thin shell of plywood reinforced by transverse bulkheads. This form of fuselage has long been acknowledged to be the most successful on account of its ideal streamline form, and its strength in proportion to its weight. Heretofore, it has, however, been little used on account of the laborious methods necessary which made it exceedingly expensive. The shell in the Longhead model is produced by applying three complete layers of plywood to a mold the shape of the body; binding cloth and casein glue being applied between the layers, which are then subjected to a uniform air pressure of 20 pounds to the square inch, which is maintained over the entire surface until the glue has set. This process produces a wooden shell one-eighth of an inch thick which is said to be stronger for its weight than any other fuselage yet developed. The upper and lower wings are supported by a V-shaped strut near the wing tips which is solidly bolted to the upper wing spars and fastened to the lower wing by a simple but rigid pin connection. The most novel and original features of this machine are the air brake and the position of the radiator. In the former, the lower wing spar is made to pivot at the body, allowing the whole wing to rotate, not only forming a very efficient lateral control, but allowing the lower plane to be thrown into a vertical position which provides an extremely effective brake, making it possible to stop the plane within about 70 feet of the point where the wheels first touch the ground, thus solving one of the chief problems of aircraft construction since the first flight of a heavier-than-air machine. This simple and ingenious brake is operated by a separate lever beside the pilot's seat.

The designers claim that the machine will land at the exceedingly low speed of 25 miles per hour, while its maximum speed is said to be 75 miles per hour—a greater range than any other present-day type. There is no reason to doubt these figures, as the almost ideal shape of the fuselage and the general distribution of weight have made it possible to operate the machine with an engine of only 25 horse-power. In these days of gigantic horse-power one would be apt to scoff at such a puny power plant till it is remembered that Bleriot crossed the English Channel in a far clumsier and heavier machine with an engine of similar power and decidedly inferior cooling qualities.

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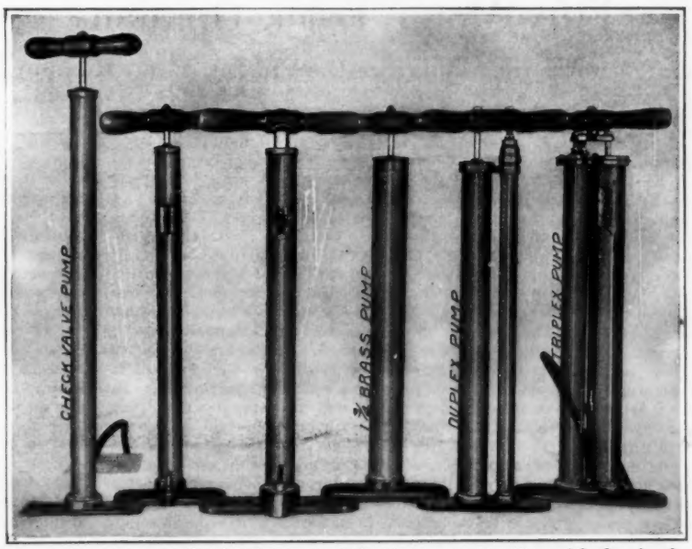


Successive stages in the development of the tire pump, starting with the simple check valve type and ending with the triplex type

The Efficient Tire Pump

By Ralph Howard

SINCE the time when pneumatic tires proved their superiority over hard and cushion construction for bicycle equipment, the pump has been a tool for serious consideration. Forgotten and often abused in long periods of idleness, to be hauled out in times of stress and hurry, it has never enjoyed much popularity.

Idleness often destroys its usefulness more than operation. Satisfactory performance depends on flexibility of the leather cups. This is retained by oil. Tubes are often dented or leaks caused by carelessness. If the love of the fisherman for his rod or the hunter for his favorite gun could be felt by the motorist for his tire pump, much of the difficulty would be overcome.

The great increase in volume of the automobile tire complicated the problem. Single action pumps of small diameters had been used. Makers at once turned to larger diameters, but found this plan had its limits, as it was humanly impossible to push down the large plunger against the higher back pressure. It was found that a 1¼-inch cylinder was about as large as could be used to get the specified pressures. The pumps already being longer than the average user would utilize in making a stroke, the capacity was thus fixed. To overcome this the two-cylinder pump was developed.

Since the energy necessary to push down a plunger against a given pressure varies directly in proportion with the area of the plunger, the idea was conceived of starting with a 1½-inch cylinder and compressing the air on the down stroke through a cross-over in the base into a ⅞-inch tube parallel to it. The ⅞-inch cup acted as a check until the up stroke when it forced the charge into the tire, combating the back pressure with its limited area. It was found that this pump could handle more than twice the amount of air per stroke of the single-action 1¼-inch, while it met with less resistance in getting it through the tire nipple.

One pump maker has recently realized the advantage of carrying the compounding principle ever one stage further, and has designed the triple pump. This takes the air into the top of a 1¾-inch tube, delivers it on the down stroke into a 1¼-inch cylinder in exactly the same way as the double compound pump did. On the up stroke this air passes over at the top and is trapped in a ¾-inch tube from which it is expelled into the tire by that very small plunger.

The advantages gained were that the three-stage pump had *five times the capacity per stroke* of a 1¼-inch single and about *twice* that of the double. It combated back pressure on the down stroke when the weight of the body could be utilized. And yet the maximum operating effort was found by actual test to be almost equal. The greatest gain of all, perhaps, was in getting air through the tire valve, as the flow of air became almost continuous, while with the other pumps, the singles especially, air was expelled in short, jerky gusts which permitted the tire valve to close after each stroke, and, of course, necessitated its reopening, thus greatly increasing the friction and the total amount of energy necessary to getting the tire up to pressure in a given time.

Two views of the Longhead biplane, which represents a serious American effort toward producing an airplane for general sport purposes

Fifty Motor Truck Opinions

What the Leading Automotive Authorities Have to Say About Highway Transportation

As Reported by Austin C. Lescarboura

THIS is the era of the motor truck. Yesterday it was the railroad; before that it was the stage coach; and still further back it was the canal. The motor truck, and by that we mean modern highway transportation, has come into its own. It has defined its field of service and established itself therein. In the field of short-haul transportation, the motor truck is the last word in efficiency.

So much for our introduction. But during these trying days of economic readjustment, following hard and fast upon a period of wartime and extravagant production and even over-production, it is well to take an inventory of the motor truck by way of determining its present status on the one hand, and of determining how it may best be used in the coming days of greater efficiency and healthier competition in all lines of endeavor. To that end we have gone to the engineers and designers and leading officials among motor truck builders—the spokesmen of the automotive industry, so to speak—for the inventory which we present in the following paragraphs:

The Paramount Question—Good Roads

The beginning of the year 1921 will see some forty-odd legislatures in session, all of which will consider, at least in a measure, the cardinal question of transportation as applied to the highway and the question of the taxation of the user of the highway. By reason of the fact that the growth of highway transportation has far outstripped the development of highway construction, it is today apparent that that construction will not carry the vehicle which is operating over it. At least, so claim the leading automotive authorities. The result is that the public has jumped to the conclusion that the cause of the destruction of highways is due to their use by heavy duty vehicles. That conclusion is not at all unnatural, in view of the fact that it is not based upon any investigation or upon any specific knowledge.

Now then, such investigations as have been made by different organizations throughout the United States, as well as by the U. S. Department of Public Roads under the Department of Agriculture, have clearly demonstrated that our highways are going to pieces, simply because they are constructed without reference to the bearing capacity of subsoil, drainage, or the construction of proper foundations. It is essential that this fact be brought to the public mind in order that its conclusion as to the cause of the disintegration of our improved highways may be based upon fact instead of upon surmise.

If the mind of the Legislature has determined that the heavy duty truck is the cause of breaking up of our improved highways, it is self-evident that it is going to legislate against the use of that truck. If, on the other hand, its opinion is based upon the facts as they really exist, if it has any elementary knowledge of the importance of transportation in this country in the distribution of its products, it will attempt to shape constructive legislation for the improvement of the highways.

The heavy duty motor truck is in the nature of a public utility and whether its use is justified or not is entirely dependent upon whether, as a transportation agency, it ultimately saves to the consumer dollars and cents in the cost of produce handled by it over the highways. This saving when analyzed will be found to be very material; if you will visualize for a moment the number of times that a spool of thread is handled over the highways, from the time the cotton, from which it is constructed, is grown, to the time when it is delivered to the ultimate consumer you will find that it has been handled considerably more than ten times, with the result that the saving of a very small fraction in the cost of hauling each time will very materially affect the competitive sales price of that article. In other words, the use of the motor truck, both in the handling of passengers and freight, is entirely an economic proposition for the benefit, according to the leading motor truck authorities, of the country at large. If that is so, there is no justification for limiting by legislation the use of the highway by that vehicle.

The motor truck fraternity in large part is therefore of the opinion that the trend of legislation should not be toward the enactment of new laws further restricting the use of the highways, but an intelligent survey of the purpose of highways and the enforcement of present laws as to their use. It is, too, of the opinion that the highway is of such material benefit to the general public that the cost of the construction of the highway should be borne by the public through general taxation. Again the authorities believe the user of the highway should pay for the maintenance of it, and therefore a tax on all users of the highway based as nearly theoretically as possible on their use of it should be enacted in order to maintain that highway in a condition which will carry the traffic which goes over it. These men do not believe that the motor vehicle is a subject for Federal taxation. It is not essentially a long-distance or inter-state carrier and it is already heavily taxed through personal property taxes, license fees, and special excise taxes.

Motor truck opinion, in general, is that the development of road legislation has conclusively demonstrated that the Federal Government should assist in the construction of important highways throughout the United States. It is particularly in favor of the Townsend Bill, which provides for a system of Federal highways constructed and maintained by the Federal Government. The experience of the industry has been that in order to effect any efficient solution of the highway problem it is necessary that the authority in reference to the highways in the various States be centralized in either a highway commissioner or a similar office in order that the State may control the development of its inter-county and main market highways along the lines of the development of Federal highways, whether constructed entirely through Federal funds or under the present method of Federal aid. The importance of the question of highway transportation has been disregarded in a remarkable manner when it is considered that all movements of produce in the course of their production from raw material to the finished products, start over the highway and finish over the highway. As a method of transportation incident to railroad transportation, and as a solution of the short haul problem, it far outranks in importance either waterways or railways.

The foregoing just about skims the subject of good roads and legislative measures toward that end. As many motor truck authorities have pointed out to us, entire volumes could be written on this phase of motor transport alone.

FOLLOWING the presentation of what passenger car designers have to say about their field, in our issue of January 1st, we give herewith a similar consensus of opinion with regard to that branch of the automotive industry concerned with the manufacture of trucks. It is plain enough that the problems confronting the truck designer are in many respects quite distinct from those with which the passenger car engineer is concerned. We have put some of these problems in questionnaire form before fifty leading designing engineers engaged in truck production, and the article on this page is our summary of the replies received.—THE EDITOR.

Engines to Fit the Fuels

Leaving the road question behind us, we come to the timely matter of engines and engine design, particularly as they pertain to the lower grades of gasoline now being handled. In general, motor truck builders are not doing as much with regard to meeting the lower grade fuels as the passenger car builders. This, in large measure, is due to the fact that many motor truck builders do not make their engines and other parts. The engines and carburetors are purchased from companies specializing in those products, and the motor truck builders are content to leave fuel problems in the hands of those concerned.

However, there is some development going on, nevertheless. Several motor truck builders are endeavoring to heat the gas being admitted to the cylinders by means of exhaust gas, the exhaust gas being controlled by a throttle. Others are installing a hot manifold on the engine so as to make the gasoline vapor more thoroughly combustible. One manufacturer is engaged in developing a satisfactory fuel for motor cars. A hot-spot manifold has been developed and is being used on at least one make of motor truck, which successfully handles one-half gasoline and one-half kerosene.

Whether or not we shall have to go to still lower grades of fuel is a controversial matter, with the decision seemingly with those who say we shall not, since we have perhaps already reached the lowest practical point. As long as there remains so little difference between the cost of gasoline and kerosene, or other similar low grade fuels, the public will not demand or put up with the inconvenience accompanying their use. But it is well to bear in mind that the situation in foreign markets is different. In some countries, the cost of gasoline is prohibitive, and motor cars and trucks are forced to operate on the low grade fuels, such as kerosene, benzol, alcohol, and so on. To meet these requirements, and, also to secure better vaporization of the present-day gasoline, certain manufacturers use motors the inlet manifolds of which are properly jacketed by the hot exhaust gases, as already mentioned. At least one make of motor truck for this year is being equipped with a special carburetor of the so-called fuel converter type. This device itself burns part of the fuel in order to obtain the heat necessary to obtain proper vaporization of the fuel before it is introduced into the engine cylinders. This carburetor will burn any kind of mineral fuel having a gravity above 36 deg. Baume. Some one-, two-, and 3½-ton trucks equipped with this new carburetor were recently shipped to the Province of Viscaya, Spain, equipped for alcohol fuel. Though not as satisfactory as gasoline, they are reported to be doing very well in Spain, where it is possible to obtain high test alcohol at a price considerably below that of gasoline. Therefore, under certain conditions alcohol can now be used.

As in the passenger-car field, the gasoline type remains supreme and unassailable despite the many efforts along steam and electric lines. The steam and electric types have failed to meet the exacting conditions of highway transportation. The many handicaps of either of these types have not been overcome to a sufficient degree to warrant their replacing the tried and proved gasoline type. The electric truck has gained some adherents, true, but only for very short hauls and in city work. As a real competitor of the gasoline truck, it is negligible, at least so long as the present designs are followed out. It may be that at some distant date we shall see a vast improvement in electric vehicles, and certain fundamental disadvantages, such as the storage battery of limited capacity, will be overcome; but it is almost certain that in our day the gasoline truck will remain as the leading means of highway transportation.

Some Remarks About Bodies

The question of bodies is not the same with motor trucks as it is with passenger cars. In the latter case the bodies may be more or less standardized—and they are in the latest offerings; but with motor trucks a special body is required for almost every special kind of service. There is little opportunity for body standardization, since to standardize a body would mean to take away from the value of any given motor truck for the peculiar requirements of the user.

Thus there is less to say about bodies than we had hoped for. Still, our question has not been entirely barren of results. One manufacturer informs us that he furnishes 95 per cent of all his trucks with bodies built for the specific work to be done by said trucks, which seems a very commendable practice. The truck is made to fit the job, so to speak, instead of warping the job to fit the truck. Others are also following out this practice in that they are endeavoring to take up individual body requirements of the users. While it is true that a standardized coal or live stock body may meet the general requirements of such services, there are bound to be times when a special body would mean a very material saving in the course of a year's service, repaying many times the small additional cost of a body especially built to fit the job.

(Continued on page 37)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Finger-Nail Phonograph

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the communication of R. E. Sneyd in your periodical of November 27, regarding the "Finger-nail Phonograph," will say that any stiff bond paper may be made to act as a reproducer in a phonograph.

One corner of the paper is placed in the groove: and then if the paper is bent a little so as to give it the right tension, the sounds may be heard faintly but distinctly, even when the ear is not in contact with the paper. If this contact is made, the sound is amplified; and I have made a very respectable reproducer by connecting a phonendoscope (one type of stethoscope) with a piece of stiff paper held in the groove of the record. I get best results with a piece of paper about two inches square.

Takoma Park, D. C. G. H. HEALD, M. D.

To the Editor of the SCIENTIFIC AMERICAN:

I notice a letter in your columns, re, the reproduction of music from a phonograph record with a finger nail. I would like to enlarge on this gentleman's remarks, having performed several experiments on this subject some years ago.

Any finger nail will give sound as long as it is long enough to reach into sound groove.

A needle held in fingers will play if finger nails of fingers holding same are at right angles to sound waves on record. A knitting needle held in teeth will sound very loud if teeth are held at right angles to sound waves. Also a small piece of tin soldered to a phonograph needle and held in fingers with needle held on record and tin left free with surface parallel to sound wave so that vibrations will cause tin to vibrate at right angles to surface will sound as loud as an ordinary reproducer without horn attached.

In fact any way in which the vibrations from record can be impressed on a solid body so as to cause it to vibrate with a certain amount of surface at right angles to vibrations will sound, the quantity of sound depending on size of same.

It never occurred to me that this matter ever needed explaining as it is so obvious when one considers the theory of sound recording and reproduction.

Red Deer, Alta. G. W. MARTIN.

To the Editor of the SCIENTIFIC AMERICAN:

The explanation of the "Finger-nail Phonograph" of which R. E. Sneyd writes in the November 27 issue of the SCIENTIFIC AMERICAN is very simple and involves no new principles. The sharpened tip of the finger nail acts as a needle, being vibrated by the impressions of the record, the remainder of the nail is forced into vibration and thus amplifies the sound. A needle held in the fingers makes a very faint sound or none at all for the reason that there is no means of amplification. If a needle is held in the fingers in contact with a piece of stiff paper, the paper will serve as an amplifier and a reproduction of the record may be heard which is even much plainer than that obtained with the finger nail.

Oakland, Ia. ERNEST LINDER.

To the Editor of the SCIENTIFIC AMERICAN:

I noticed the letter from Mr. R. E. Sneyd in your issue of November 27, under the above caption.

I have tried several experiments with phonographic apparatus, and among them the two which Mr. Sneyd mentioned. Although I found the sound from the finger nail to be somewhat more distinct than from a phonograph needle held between the fingers, I could distinguish the melody quite readily in either case.

Mr. Sneyd suggested that perhaps an anatomist or scientist would explain these phenomena. I am only a high school student and do not profess any attainments in these lines, but if Mr. Sneyd will use for the same experiment a piece of metal or hard wood sharpened so as to be actuated by the undulations of the spiral groove, I think he will find the matter to be completely explained. The difference, I believe, is simply this: in the case of the phonograph needle there is a relatively small surface from which the sound waves may radiate, while the finger nail and the bit of metal not only have larger surfaces, but are more correctly shaped to act as transmitting diaphragms. The factor of the difference in the composition of the material used may also enter the question, as the vibrational response of metal is in almost every case weaker than that of wood and similar substances.

Perhaps the action of the media in the above cases may be more readily understood by comparison with a similar case on a larger scale. If a phonograph needle is secured in the end of a shingle or any light, thin piece of wood, the whole may then be used in the same way as was Mr. Sneyd's finger nail. The result is almost perfect reproduction of the recorded waves, sometimes with as much clarity as with the machine-made reproducer.

I am a regular reader of the SCIENTIFIC AMERICAN, and I find many things in it which are very instructive as well as highly interesting.

Fort Scott, Kan. DUDLEY M. WHITESIDE.

To the Editor of the SCIENTIFIC AMERICAN:

With reference to Mr. Sneyd's so-called discovery in regard to reproduction of phonographic vibrations, the writer wishes to take exception to the last statement made, namely, that no sound is heard if the needle is held in the fingers. A trial will convince one that the vibrations are produced fully as powerfully in this way as in the method cited, and by placing the ear against the hand the strain of music or enunciation of words may be detected. Further, if the needle be held between the teeth, the head and mouth cavity will act as resonator sufficiently to enable others to hear the reproduction, and this will be particularly clear to the experimenter on account of the transmission of the vibrations directly to the ear by the solid bones of the jaw. A. B. BINFORD.

Piqua, Ohio.

A Poetic Soul Breaks Loose

A Contributor on the Pacific Coast, whose interest was aroused by the recent reproduction in our columns of the Albuquerque reporter's noble efforts to tell his readers what the speaker had said about the make-up of the universe, sends us a gem of slightly different sort. This, so far as we can judge from the clipping, is a voluntary contribution by one of the subscribers of some very small-town weekly. He is so proud of his literary ability that he signs his name. If his excursion among the wonders of the world had operated to still his pen as well as his tongue, the world would indeed have been the poorer. We reproduce his effusion faithfully:

It is said the astronomer Homer sang and worshiped these same stars, and may not come we, every thirsty inquiring mind, let us venture into the realm of the velvet blue above what wealth what beauty is in store, see your beautiful evening star one of the most beautiful of the planets how I love to gaze upon her she bears me through infantude my imagination soars aloft. I have visited some of natures wonders of great views, have looked from top of Lookout Mountain on bottom of the great Atlantic through Mammoth Cave beneath the thundering Cataract of Niagara Falls which so filled me with wonder and admiration as to make me speechless. But all of these are tame compared to the revelations brought to me of the beauties of heaven at night through a telescope.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of November 27, Mr. Sneyd mentions the possibilities of obtaining a faint reproduction of a phonograph record through the use of the finger nail. He states that an ordinary needle will not produce any sound. I have, however, reproduced records frequently with an ordinary needle or pin. While the resulting sound is very feeble, it may be materially increased if the pin is stuck through the corner of a small box, thus forming a sound box. If the box used is of tin, a fairly clear reproduction results, though of course with a rather metallic sound.

A READER.

Steam-Heated Gutters for Snow Removal

To the Editor of the SCIENTIFIC AMERICAN:

It is strange, in view of the mechanical genius of the age, that our cities are so helpless in a snow storm such as ordinarily may be expected any winter. The damage and loss and sickness and death in a great city are incalculable as the result of our still being limited to the archaic method of waiting till the storm is over then shoveling snow on to carts and dragging it to the dumps.

The writer offers the following suggestion conscious of deficiency in detail, but in the hope that it might be worked out experimentally on a small scale without too much expense.

Sink in the gutters steam radiator pipes with an open drain. Perhaps the most serious problem would be to keep this open. A small drain will serve to carry off the snow water, as it melts, into the sewers. Connect the radiator pipes with central steam generating plants as now operating. At the very beginning of a snow storm, start street sweeping machines without a moment's delay, sweeping the snow as it falls. These assigned to proper areas should be able to keep up with the accumulation in brushing on to the steam-heated gutter whose small protected drain will carry the water into the sewer.

Every hour's work so will save days later. If a high wage is demanded to work in the snow storm or at night, properly clothe and pay the men enough inducement. Heat applied to the snow from above radiates into the air and is wasted, but every unit is used when the conveyor of the heat is covered with the snow. The live steam under the snow banks will soon run them off in water into the sewers.

New York. RALPH GODDARD.

Cipher Literature

To the Editor of the SCIENTIFIC AMERICAN:

Can any of your readers tell me the name of any modern comprehensive work on the art of cipher writing and deciphering, or the name and dates of any magazine wherein articles on the art may be found? I am a novice in the art, but keenly interested in it, and perhaps some of the experts among your readers will be good enough to tell me how and where I may acquire some knowledge of the methods they use in deciphering. I noticed a number of letters on the subject in your correspondence columns during the war, but have noted an absence of all reference to it during the past year or two. Perhaps some of your readers can inform me. BERNARD THOMSON.

169 Pender St., W.
Vancouver, B. C.

Jeweler vs. Jack-of-all-Trades

To the Editor of the SCIENTIFIC AMERICAN:

A few months ago there appeared in your correspondence columns a letter telling of the putting of an open vial of kerosene in the case of a balky clock to improve its running, and later a letter from a clock maker, or repairer, ridiculing the idea as being of no value, and, if I remember aright, rather hauling you over the coals for allowing so unscientific a method to appear in your columns.

The idea of putting kerosene in the case of a clock is very old, and it is undoubtedly good though it keeps many a dollar at home and out of the pockets of the clock repairer. I doubt if you could find many of the old wooden-case clocks without its open vial of kerosene.

I have just gone the kerosene idea one better. I have in my office a large wall clock which has refused to run for the past three years without its vial of kerosene. Two months ago it stopped and no amount of coaxing would make it go. It was impossible to take the clock down at that time for cleaning, so the kerosene was poured out and gasoline substituted and in five minutes' times it was running as well as it ever did.

The writer has been a pretty constant reader of the SCIENTIFIC AMERICAN since 1866 and swears by it. I regret, however, to see the falling off in the number of "Queries" and your replies. A READER.

A Just Criticism

To the Editor of the SCIENTIFIC AMERICAN:

In the October 30th issue of the SCIENTIFIC AMERICAN you published an article, on the title page, on "The Rate of Speed at Which Bacteria Travel." On page 435 of your issue of October 23rd, in an article on "Painted Coffee," you say: "The paddles revolve at a high rate of speed," and in several other places recently I have noticed that you use the expression.

Will you permit me to suggest that you abandon the term and substitute therefor "speed" or "velocity," either of which means rate of motion.

If it means anything, "Rate of speed" means "Rate of the rate of motion," which I fancy is not what you intend to say.

WM. E. GIBBS.

New York.

Where Is Cleveland?

OWING to an oversight on the part of our contributor, we placed the paper on Alcohol Obtained from Coke Oven Gases, noticed in our issue of August 21st last, with the Cleveland (Ohio) Institution of Engineers, instead of with the organization of that name in Cleveland, England, where it was actually read.

X-Ray Tubes by the Hundreds

How the Trained Mechanic and the Skilled Glassblower Have Been Replaced by Automatic Machinery

By George Gaulois

QUANTITY production has become so commonplace of late that it is the rule rather than the exception in many industries. The manufacture of thousands upon thousands of parts in various metals and their assembly into hundreds upon hundreds of finished machines is a remarkable undertaking, true; but the process is merely an elaboration upon the usual lathe, drill-press, boring mill, and planer, coupled with the systematic routing of the materials and parts through the factory.

In the manufacture of X-ray tubes the work must of necessity be of the most delicate and exacting sort. Indeed, heretofore X-ray tubes have been produced by the most painstaking handwork, one at a time, to meet the steadily-increasing demand. The metallic electrodes and accessories have called for the finest kind of machine work—some details being quite comparable to watchmaking—while the glasswork has required the skill of an expert glassblower. Little wonder, then, that most of the world's X-ray tubes came out of Germany and France during pre-war days, where skilled workmen still continue to practice their handiwork in much the same painstaking manner as their predecessors of the medieval trade guilds.

How, then, could quantity production methods be applied to the manufacture of X-ray tubes? Of course, the automatic machinery in general use might well be put to work on some of the simpler metal parts of the tubes; but how about the delicate glassware? How could anything take the place of the glassblower's carefully controlled blow-torch and deft hands? To be sure, it would seem that X-ray tubes were intended to remain a hand-made product.

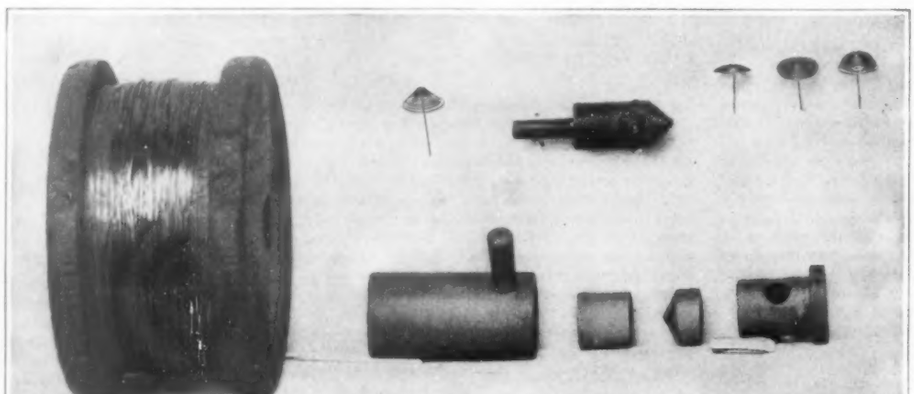
The demand for X-ray tubes has increased by leaps and bounds. Whereas but a few years ago X-ray outfits were to be found only in the leading hospitals and in the hands of X-ray specialists, today there are outfits in the hands of many dentists, doctors, research laboratories, manufacturing plants, schools, and other institutions. X-rays are no longer confined to medical and surgical uses; industry has found more than one way of employing X-rays in examining materials for hidden flaws. Obviously, the tubes have fallen into the hands of persons possessing little if any technical training in electricity, hence it has been necessary to produce a simple and uniform X-ray tube which could be handled with almost the same facility as the ordinary electric bulb.

It has remained for one of our foremost electric companies to develop a quantity production system for manufacturing X-ray tubes. At the present writing that organization is turning out over one hundred tubes every working day—one hundred tubes or more of excellent and uniform quality. The tubes are of the Coolidge universal and radiator types, and the process of manufacture may be divided into the following stages: 1. Preparation of the metal parts. 2. Assembly of the X-ray tube. 3. Exhaust of the assembled tube. 4. Testing of the finished tube.

Now tungsten is one of the essential metals entering into the construction of the anode and cathode of the Coolidge tubes. The complicated process required for the production of this metal was evolved in connection with the incandescent lamp development, and a complete description of this interesting process will be found on page 130 of the SCIENTIFIC AMERICAN dated August 7, 1920.

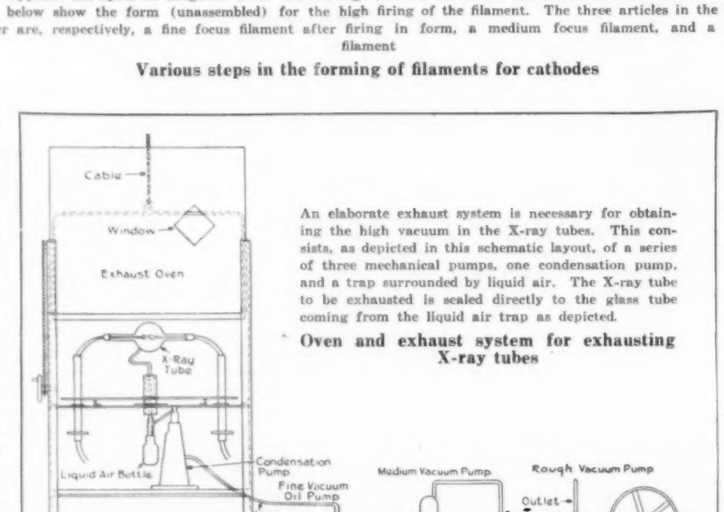
Tungsten cannot be worked mechanically while cold. It is so hard that it cannot be machined by sharp-edged tools, but has to be brought into desired shapes by high temperature hammering or cold

(*Continued on page 38*)



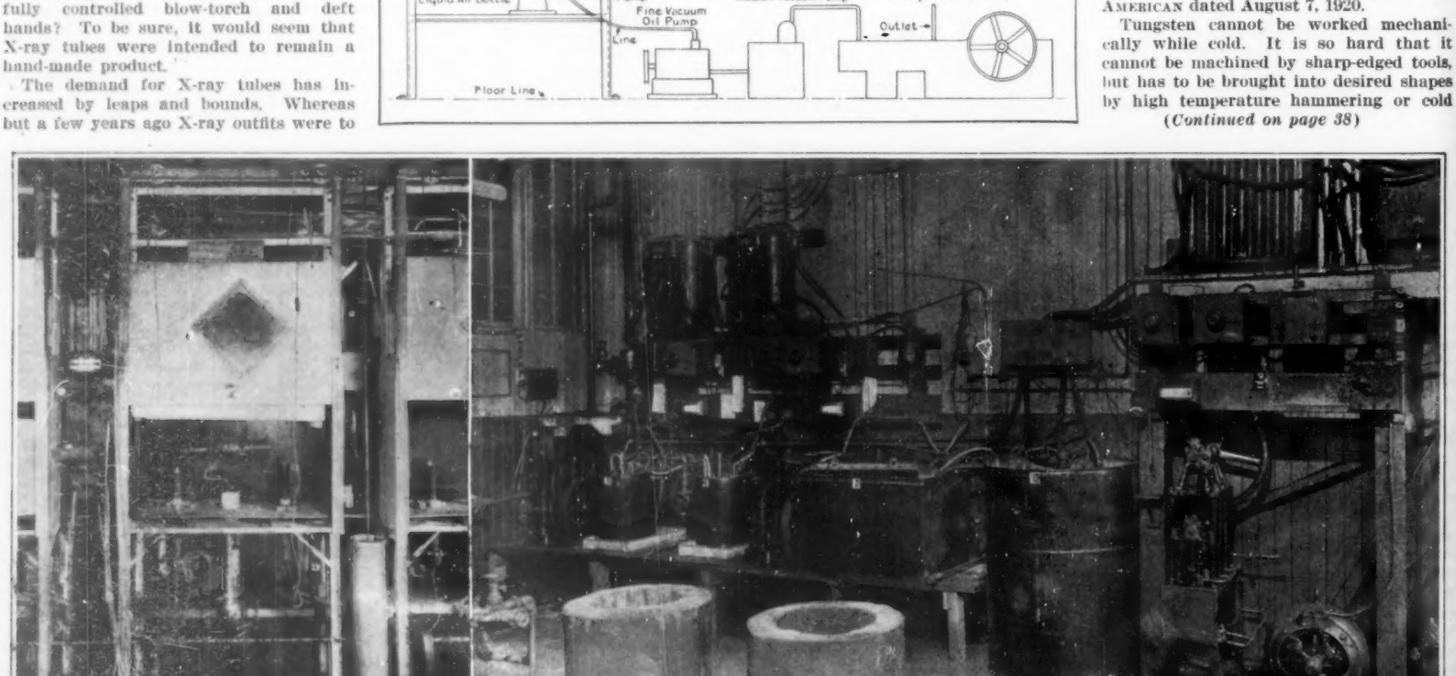
At the left appears the spool of tungsten wire. At the right, above, is shown the mandrel with filament wound on it. The pieces below show the form (unassembled) for the high firing of the filament. The three articles in the upper right-hand corner are, respectively, a fine focus filament after firing in form, a medium focus filament, and a broad focus filament

Various steps in the forming of filaments for cathodes



An elaborate exhaust system is necessary for obtaining the high vacuum in the X-ray tubes. This consists, as depicted in this schematic layout, of a series of three mechanical pumps, one condensation pump, and a trap surrounded by liquid air. The X-ray tube to be exhausted is sealed directly to the glass tube coming from the liquid air trap as depicted.

Oven and exhaust system for exhausting X-ray tubes



Left: Exhaust oven for the universal type of tube with the tube in position. *Right:* Electric vacuum furnace used for firing metal parts of the X-ray tubes

Speaking of Scaffolding—

WITH the shortage of office space in New York City during the past few years, New Yorkers have engaged extensively in changing over existing buildings so as to get the most space and the greatest efficiency from them. A case in point is one of New York's oldest office buildings. This building was recently bought by a shipping concern and work begun to remodel it both inside and outside. During this work the building has been covered with a mass of scaffolding to accommodate the stone-cutters, bricklayers and others, as shown in our photograph.

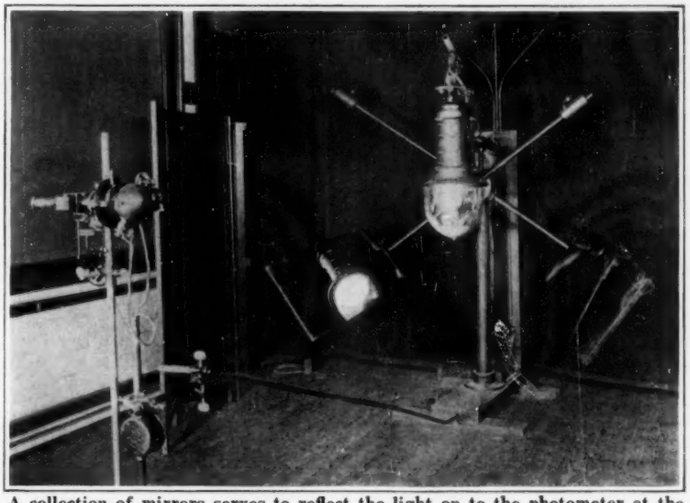
Overhauling one of New York's oldest office buildings: a study in modern scaffolding

Getting the Candlepower Reading from All Angles

USED during the war in measuring the distributing power of flashlights, an apparatus designed by the United States Bureau of Standards has been adapted to uses of measuring light distribution of lamps. The instrument can be employed in taking the candle-power from any angle—a radical improvement over the older type of photometer which recorded the lighting strength only from a horizontal position.

As can be observed from an examination of the photograph, mirrors serve utility purposes other than reflecting the facial expression posed in Milady's boudoir. The series of mirrors in suspension, shown in the background, reflect light to the portable photometer in the foreground of the illustration. A graduated circle shows the angle at which the readings are taken. From the photometric values at varying angles the distribution curve may be constructed.

This design of distribution photometer is capable of measuring the light distribution of all kinds of units, the candlepower being registered from any angle. Any kind of lighting measurement can be calculated.



A collection of mirrors serves to reflect the light on to the photometer at the left, thus indicating candlepower from any angle

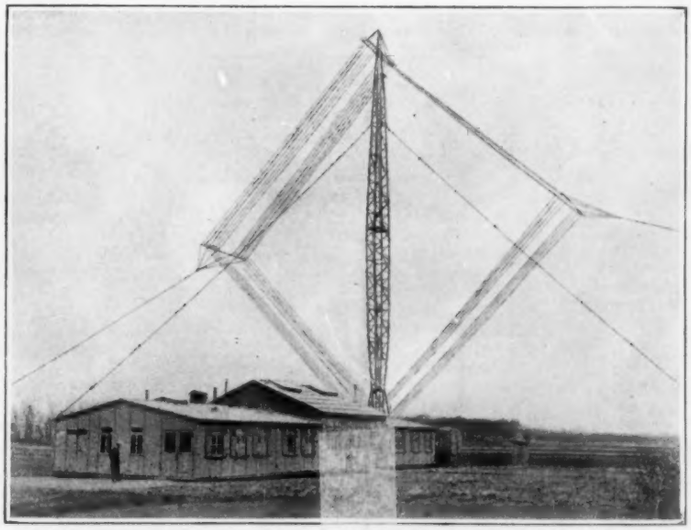
The Superlative in Loop Antennae

SPEAKING before a distinguished gathering at the recent opening of an intercity radio communication service between New York, Cleveland, Detroit and Chicago, Dr. Lee DeForest, the radio pioneer and inventor, brought out the fact that where such an enterprise had failed fifteen years ago, it would succeed today.

The difference between both attempts is one of relative technical knowledge and equipment. Fifteen years have made a vast difference in radio communication. Fifteen years ago the transmitters were crude and inefficient, propagating in the form of wireless waves but a small part of the energy put into the transmitter. Yet the greatest handicap was in the receiving apparatus which, without the present-day ultra-sensitive detectors and the remarkable amplifiers, were unable to weed out undesirable signals and nearby interference without weeding out the desired signals at the same time. Weeding out, in the radio sense, means the process of elimination carried out until only the desired signals remain. But unless they are sufficiently powerful to begin with, or very sharply defined in wave length so as not to conflict with undesirable signals, or, again, unless there is some means of amplifying or building up the almost infinitesimal and generally inaudible impulses that sift through the weeding-out circuits, the weeding-out enterprise is doomed to failure.

Thanks to the introduction of Dr. DeForest's audion, or three-element vacuum tube, radio communication for inter-city communication and for other applications where there is a great deal of interference due to a large number of stations working in a limited area, is now feasible from a technical standpoint. Furthermore, loop antennae may be used in place of lofty aerials, at least for receiving purposes, and such loops, because of their directive properties, further strengthen the desired signals by weakening or eliminating the undesired signals. The loops are now used to a considerable extent because they eliminate static or atmospheric disturbances, thus making radio communication far more reliable than heretofore. The vacuum-tube amplifiers permit the slight currents induced in the loops to be amplified to such degree as to be altogether audible.

It appears that Germany has been conducting extensive experiments with loop attennae, the loop shown in the accompanying illustration being probably the largest in present use. It measures well over 130 feet in diameter, and is supported by a single lattice mast. From the meager reports filtering through to us, it appears that this loop is being used in experimenting with inter-city communication, in which case it is desirable to direct both the transmitting and receiving antennae in order to reduce interference to a minimum and to concentrate, instead of spread, the wireless waves.



A giant loop antenna measuring 130 feet across, used in Germany for inter-city communication tests

Important Swiss Discovery Affecting Watchmaking

A DISCOVERY that is reported by the press as being capable of revolutionizing the watchmaking industry has just been announced by Mr. C. E. Guillaume, director of the International Bureau of Weights and Measures. A successful method of regulation, remedying the variations in time of a watch due to the expansion and contraction of its parts caused by variations of temperature, is the result of Mr. Guillaume's invention. This so-called "secondary error" has always been one of the great obstacles in the attainment of perfection and precision in the watchmaking industry, and if this difficulty is overcome the watchmaking industry should receive very considerable impetus, owing principally to the simplifying of the process of regulation.

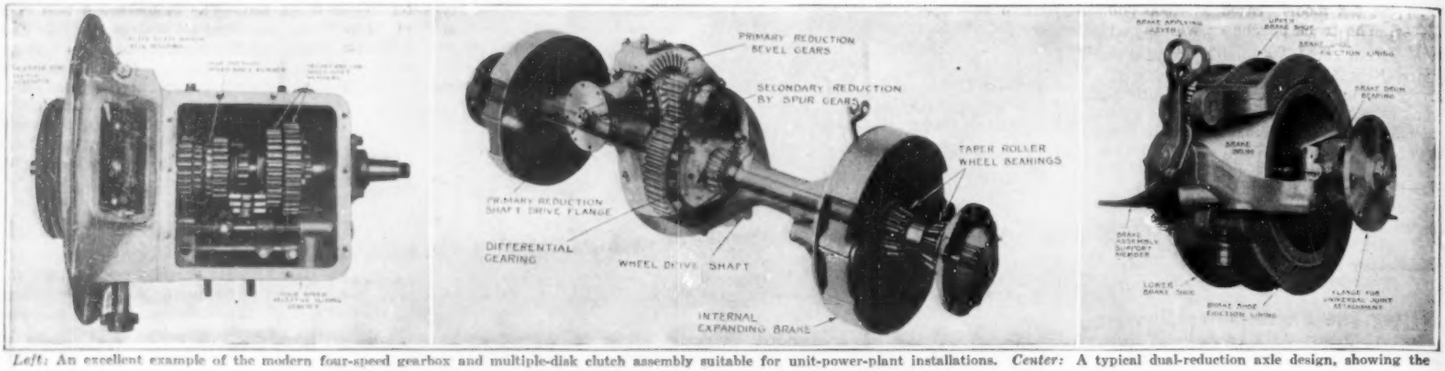
The chief feature of Mr. Guillaume's new process is a change in the alloy used in the compensating parts. The minimum expansion of nickel steel was found to be increased by the addition of 12 per cent of chrome as well as a very small quantity of tungsten, manganese, or carbon. By mounting a spiral of this steel-nickel-chrome alloy in the watch, according to Mr. Guillaume's announcement, the problem of compensation has been solved and the "secondary error" removed.

Extension of Air Service Between the Netherlands and Great Britain

ANNOUNCEMENT is made that the airplane mail and passenger service which has been operating daily between the Netherlands and Great Britain since May, 1920, has been extended so as to include a daily service to Denmark and Sweden by way of Germany. Under the new arrangement, which went into effect September 15, passengers and mails can leave London either by way of Croydon, at 10 A. M., or by way of Cricklewood, at 4 P. M., and reach Amsterdam that evening. From Amsterdam the journey is continued at 8:50 A. M. the next day, with stops at Bremen at 11:50 A. M., Hamburg at 1 P. M., and at Copenhagen at 3:30 P. M. A branch or supplementary service leaves Bremen in time to reach Berlin at 3:30 P. M. By this service the trip from London to Copenhagen is advertised to be made in 24 hours, as compared with 40 hours by steamer or rail and steamer. Owing to the early approach of winter in this latitude, it is regarded as impracticable to attempt to make the trip in one day at the present time, but it is planned to accelerate the service next spring.

The entire service for passengers and mail between points in the Netherlands and London and elsewhere has been more or less experimental during the whole of the past season. The plans of the company operating the machines include the organization of a network of services all over this part of Europe, and the service so far given has been more or less in the nature of an attempt to find out what routes are commercially and otherwise practicable. The service between the Netherlands and England has been carried on without a single interruption and with increasing success. The service from Holland to Great Britain carries more passengers than freight, whereas that from England to Holland carries more freight than passengers.

The mail service to Great Britain averages about 480 letters per day, letters for the service simply being marked for the air post and double postage paid.



Left: An excellent example of the modern four-speed gearbox and multiple-disk clutch assembly suitable for unit-power-plant installations. *Center:* A typical dual-reduction axle design, showing the components. *Right:* An external constricting shoe brake.

Some of the features of the 1921 motor truck, which account for the growing list of motor truck users

The Trend of Motor Truck Design for 1921

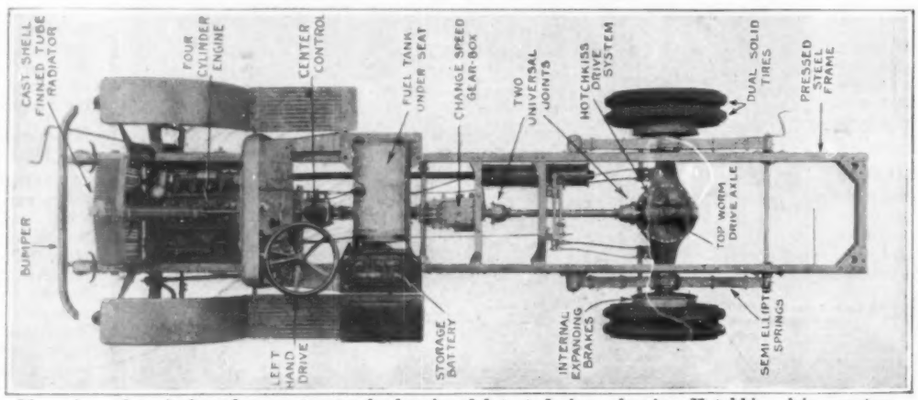
A Brief Survey of the Features Displayed by Six Hundred and Eighty-two American Models

By Victor W. Pagé, M.S.A.E.

IN analyzing motor truck specifications in an effort to determine the trend of engineering practice there are two ways of considering the various truck designs. One of these is by taking the total production of trucks; the other and fairer means, in the writer's opinion, is to consider the number of distinct truck models apart from the numbers in which any one make of truck is produced. In considering truck-design progress upon the former premise one will find a number of things that are not at all true when considered from the other point of view.

For example, there are very large numbers of light motor trucks and "speed wagons" produced in which spiral-bevel driving-gearing is used, yet when considering the total number of distinct models offered, the spiral-bevel drive gearing is found to be a very small percentage of the final-drive system favored by truck designers. If one considered merely the quantities of trucks manufactured as a criterion for basing opinions on the progress of design it would be seen that the planetary transmission system and transverse front and rear springing were used on a large number of trucks, though all of these would be of one make. The same thing applies to internal gear drive axles; if one considers total production it is found that this method of final drive is used on a large proportion of motor trucks built in this country. If one considers the subject from the number of distinct models of trucks offered, bearing in mind that each of these represents some individual designer's preference, we find that the larger percentage of models favors the worm-gear drive.

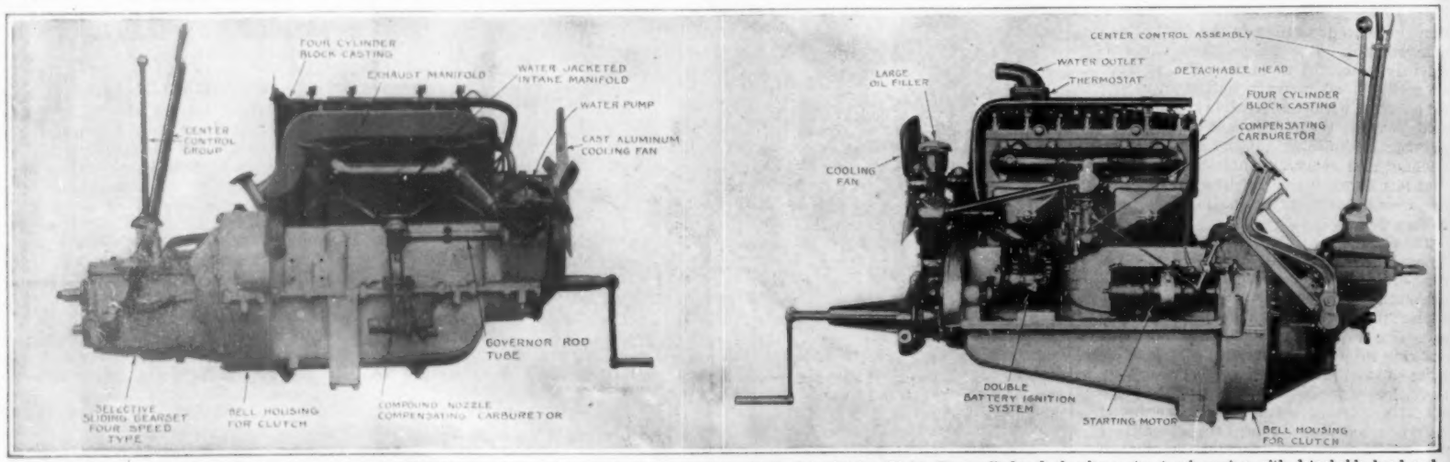
In order to determine the trend of modern practice with some degree of accuracy the writer went over the advance specifications of 682 truck models, ranging in capacity from 1,000 to 15,000 pounds. The conclusions arrived at are given in a general manner without computing percentages, as it is believed that the readers of this publication are more interested in a plain discussion of the trend of modern practice than they are in an engineering discussion supported by more or less accurate percentage values that may be open to question according to the way they are interpreted by the individual. This interpretation in turn is often guided or formed by personal prejudice in favor of some one form of construction.



Plan view of typical modern motor truck chassis of latest design, showing Hotchkiss drive system, semi-elliptic spring suspension, internal expanding brakes, and pressed steel frame

Considering first the classification of models available according to load rating we find that the 1½-ton truck is the most popular inasmuch as 127 distinct models of this capacity are available. The next most popular size is the 2½-ton truck with 108 models and a close third is the 2-ton or 4,000-pound class with 107 models offered. There is so little difference between these two classes that one may safely say they are equally popular. Ninety-seven models of 3½-ton capacity are offered and, strange to say, there are as many as 75 distinct models of 5-ton trucks. The 1-ton truck is marketed in 68 distinct models; there are only 6 commercial vehicles rated at 1,000 pounds capacity or less; and 23 models ranging from 1,000 to 1,500 pounds capacity. Certain makes of these, however, are produced in very large quantities so that trucks of 1-ton capacity or less are probably produced in larger numbers than any other class.

There is a commendable tendency to depart from odd or fractional ratings because these are apt to prove confusing to the truck purchaser. No truck is ever loaded just to capacity, and as a matter of fact most trucks are overloaded; so there is nothing to be gained in having some truck classes that differ by only 500 pounds from others. To show how few the models are of such intermediate capacities between the main classification heads we



Left: Latest type of unit power plant for motor truck includes a four-speed selective gearset and multiple disk clutch. *Right:* Four-cylinder dual valve motor truck engine with detachable head and clutch housed in motor bell housing. Note the clean cut and compact appearance of this power plant, which is typical of modern motor truck engineering practice.

Typical motor truck engines, gearset and clutch units, showing the development along simpler and more compact lines

find but six models rated at 2,500 pounds and two at 3,500. The truck purchaser who is in the market for a 3-ton truck may make his selection from 24 distinct models while those in need of 4-ton trucks have 17 models to choose from. Considering capacities over 5 tons, one finds specifications for 3 of 11,000-pound capacity, 7 of 6 tons, but one model of 6½ tons, 6 models of 7 tons and 2 of 7½.

The next point to consider is the engine power provided for the various models and while there is considerable diversity and at first glance no uniformity of opinion among the various designers as to the best horse-power for a given capacity, a more careful analysis of the specifications enables one to divide practically all of the engines used into five classes. In the trucks ranging from 1,000 to 2,500 pounds capacity, inclusive, one finds that engines approximating 22.5 horse-power are the most popular. Most of the trucks in the 3,000 and 3,500 pound classes have engines rated at 25.6 horse-power. Power plants having an average rating of 27.2 horse-power are found in trucks ranging in capacity from 2 tons to 2½ tons, though many of these have engines rated as low as 22.5 horse-power and a few in excess of 32 horse-power. In the 3-ton class the most popular engine rating seems to be 28.9 horse-power though even in this classification one finds a few engines of 22.5 horse-power. The highest engine rating in the 3-ton class is 42.8 horse-power. Trucks ranging in capacity from 7,000 to 8,000 pounds seem to require an average of 32.4 horse-power though some of these are provided with engines rated as low as 25.6 horse-power while other designers seem to think that 36 to 42.8 horse-power engines are necessary to carry the load satisfactorily. In trucks of 4-ton capacity and over, the most popular engine rating is 36 horse-power.

There are many factors which enter into determining the amount of power required for a truck of given capacity, among which may be mentioned the method of final drive and the road speed desired. The type of change-speed gear-box and whether it has three or four speeds and whether or not the truck is intended to be used with pneumatic tires must also enter into consideration. As the carrying capacity of the truck increases it is good engineering practice to reduce the maximum speed with increasing truck weight. The reason for this is obvious. The momentum that would be acquired by a heavy truck traveling at high speed would make it extremely difficult to control, and it would not only be dangerous in traffic but it would be far from economical to operate on account of the large engine demanded. Besides, the depreciation of our highways, which even now are not built with an adequate conception of what they must be able to resist when subjected to motor traffic, would be so great that legislation would be necessary to curb truck speeds. When heavy trucks travel at low speed it is possible to use engines of comparatively low horse-power ratings because the power is utilized in an efficient manner and the engine runs more nearly at a constant speed than when the speed range is greater and more power is provided than is necessary for the majority of operating conditions.

Practically all motor trucks, regardless of load rating, are equipped with four-cylinder power plants, and nearly all trucks of over one-ton capacity have automatically-governed engines. The popularity of the four-cylinder motor for truck use and the unanimity of opinion on the part of truck designers regarding the best type of power plant can be well understood when it is stated that of the 682 specifications analyzed, the writer found but two trucks equipped with six-cylinder engines and but two with eight cylinders. The only good reason for using engines of more than four cylinders in motor trucks that the writer can advance is that the designer wanted to use something different from what the consensus of contemporary opinion indicated as desirable, in order to provide his salesmen with a few new talking points. One familiar with trucks knows that the type of engine that is the most suited for passenger car propulsion is not the best type for motor truck use. The motor truck is a commercial proposition and demands a power plant of maximum simplicity, reliability and economy. The four-cylinder engine incorporates all these features to the highest degree. There is but one make of truck that is sold to any extent that uses an engine of less than four cylinders but this one is produced in fairly large quantities and its two-cylinder opposed horizontal-type motor has given such good service for a long term of years that the makers have not considered it necessary or desirable to provide a different engine.

Practically all commercial vehicles are provided with water-cooled engines, there being only two makes fitted with air-cooled engines, one of these being an unconventional two-stroke-cycle engine produced in very small quantities while the other is a brand new offering of a well-known air-cooled passenger car maker who has brought out a light delivery truck equipped with the same type of engine used in his passenger-carrying vehicles. Forced water circulation by means of positively driven circulating pumps is most generally applied though the thermo-syphon or natural system of water-cooling seems to be gaining in popularity, especially on trucks of less than 2-ton capacity. The lubrication systems of practically all engines operate on the combined force feed and splash principle in which oil is drawn from a sump at the base of the engine by a pump and forced to the main bearings and, in some cases, through a hollow crankshaft to the connecting-rod end-bearings. The surplus oil flows to troughs in the engine base, into which splashers attached to the lower ends of the connecting rods dip at each revolution of the crank, distributing the oil in the form of a spray or mist, to all points of the engine interior such as the camshaft and its bearings, the cams and valve-lifters, the wrist pins and the piston and cylinder walls.

Water-cooling is by tubular radiators having finned, cast-metal upper and lower tanks and a cast-metal

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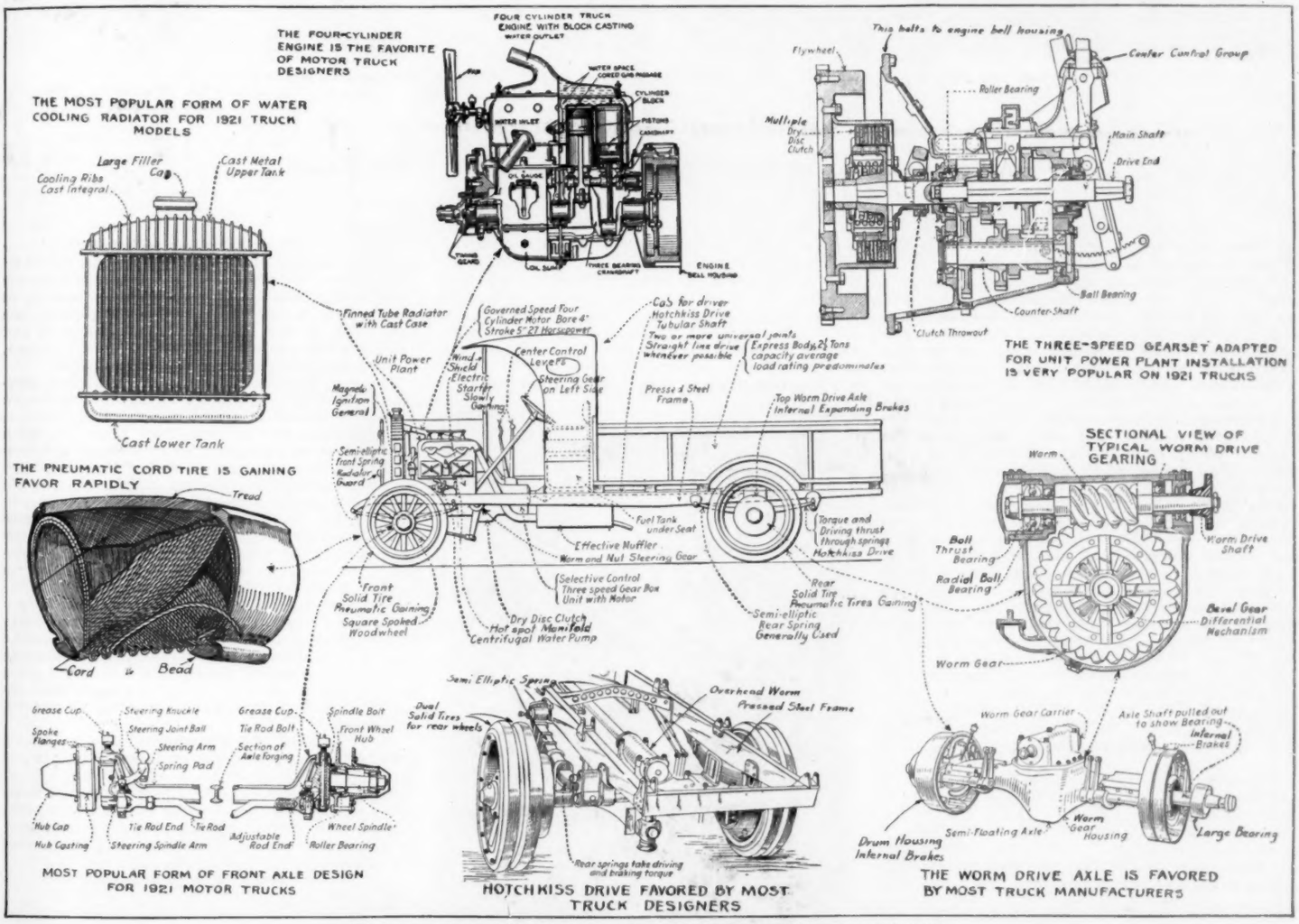
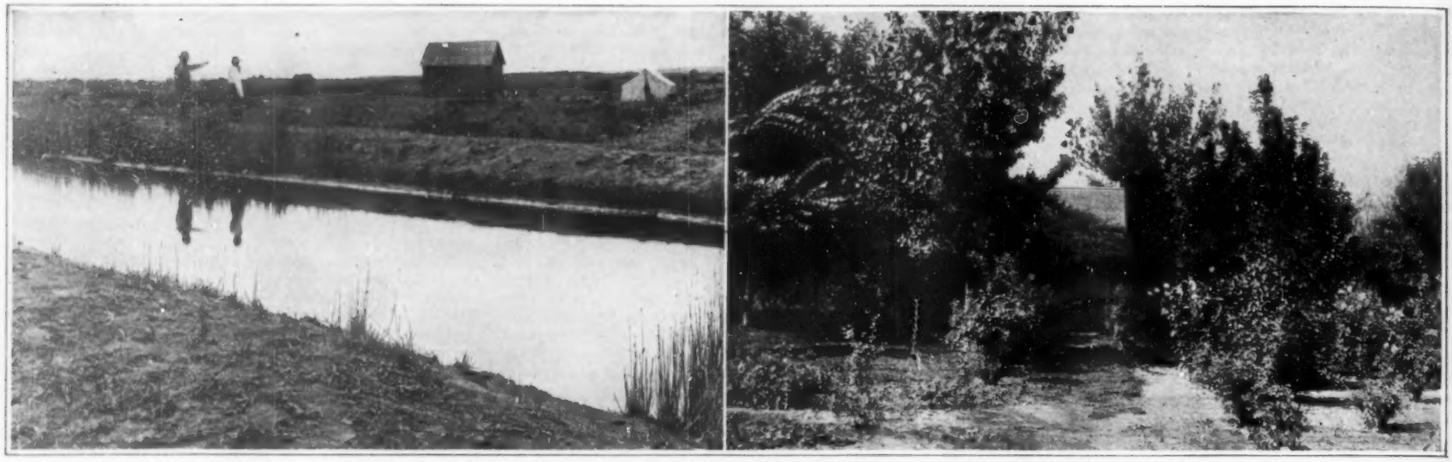


The composite truck for 1921, together with its distinguishing characteristics



Before and after reclamation. The same homestead on the Umatilla Project, Oregon, in 1909 and in 1914

Something for Nothing

A Combination of Engineering, Water and Land That Makes Wealth

By C. H. Claudy

TO one part of science add two parts of engineering, stir in some partisan politics, add the pinch of the high cost of living—and get this story. It seems a queer mixture. Yet science, engineering, politics and the high cost of living have a common meeting ground in a subject of real importance to all Americans and of vital importance to half a million of us—that subject being the reclamation of waste land by water.

The average price obtained from the products of all the acreage under cultivation in the United States last year was something less than $17 per acre. The average price obtained from the products of all the irrigated acreage in reclamation projects under cultivation in the United States last year was in excess of $80 per acre.

Prior to the establishment of these reclamation projects, the average yield from the acres now irrigated was exactly $0.00. Indeed those acres were a real expense to Uncle Sam, since they then paid no taxes, produced no crops, fed no people, provided homes for none. Be it noted also that the acreage available under existing projects is not yet working to its maximum capacity. Crops worth $88,609,969 were taken from 1,103,500 acres in reclamation projects in 1919; but 1,177,210 acres were irrigated in that year and 1,633,759 are irrigable under existing water supplies as developed by the reclamation engineers. In other words, reclaimed lands were only sixty-eight per cent cropped in 1919, and the 88½ millions would have been 130 millions had all the irrigable areas been cropped.

But the entire expense of the whole reclamation system from its very first beginning in 1902 to the end of June 1920, has been but $123,178,779.77!

He who runs and reads will not need to have it pointed out very definitely that if the United States had borne the entire cost from the public pocket, reclamation would be a paying investment. A farmer who invests ten thousand dollars in equipping a farm and gets back his entire outlay in two years with a big profit is more than satisfied. The United States has invested one hundred and twenty-four millions in reclamation and reclaimed acres brought back eighty-eight millions in one year. The total crop value from reclaimed lands, for all years since the service started, is greater than a quarter of a billion dollars. Would any sane man refuse to invest a dollar to get back two?

But this is but the beginning of the story. If one allows $10 an acre as the value before irrigation of all lands under irrigation now, the total pre-irrigation value of the land is not quite eighteen millions of dollars. And it was public land, non-taxpaying. The total value of land in the projects, cities, town and villages within projects, and created by the projects, is today nearly six hundred millions of dollars.

To spend 124 millions and reap 600 millions in property, besides 250 millions in income, would seem a reasonable gamble to almost any speculator, even if the speculation was eighteen years long. But when the fact that the United States is *not* paying for reclamation is brought into the discussion the matter takes on a very different complexion. Reclamation is not a gift of the American people to the half a million of them directly benefiting under it. Farmers who take up reclaimed land pay for it, and the payment includes the cost of all the irrigation from which the land benefits. The total cost of a project is divided by the number of acres to benefit from that project and the farmer pays the bill. True, he doesn't have to pay it all at once or quickly; the United States requires five per cent on taking possession as a guarantee of good faith, after which the farmer has five years to get himself financially independent and fifteen years more to pay the balance. But the point is that the money spent comes back, and is spent again, and again comes back.

The reclamation fund is a revolving fund and should work in perpetuity (or until all irrigable land is irrigated).

Here is the point. The fund isn't big enough to enable reclamation work to be done as fast as the public, the high cost of living and the need for greater good-crop acreage demands. It is here that politics raises its head and peers over the horizon.

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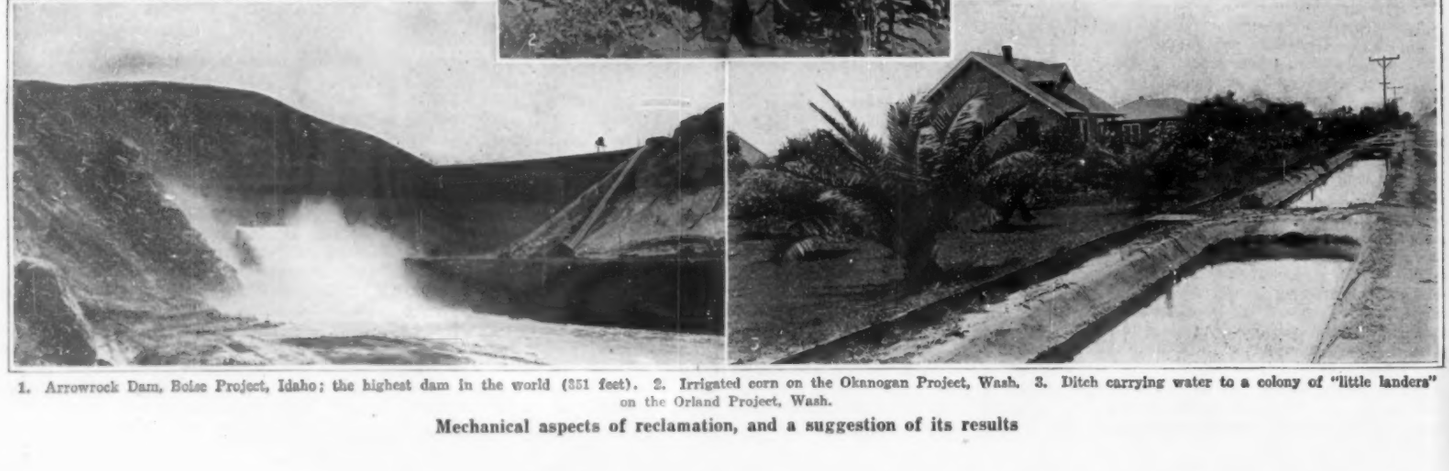


1. Arrowrock Dam, Boise Project, Idaho; the highest dam in the world (351 feet). 2. Irrigated corn on the Okanogan Project, Wash. 3. Ditch carrying water to a colony of "little landers" on the Orland Project, Wash.

Mechanical aspects of reclamation, and a suggestion of its results

When the Pony Hauls the Airplane

INGENUITY seems at its best when it thrives at a summer resort. For nowhere else does one find so many simple yet unusual ideas put to work to earn a handsome income for their originators.

Thus some bright young man hit upon the idea of the pony cart fashioned like an airplane, as shown in the accompanying view. Fifteen of these carts were constructed and put into operation at Atlantic City, N. J., in order to extract money from fond parents who have neither the heart nor the inclination to deny every little whim of their persistent offspring. The pony airplane cart is reported to be a real business success.

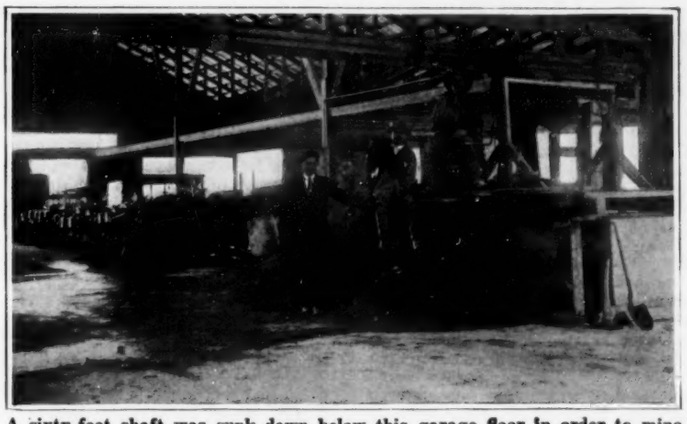
Fifteen of these odd airplane pony carts are earning big returns for the man who conceived this simple yet unusual idea

A Gold Mine in a Garage

SOME time ago while excavating for a large underground gasoline tank at the Grass Valley Garage, Nevada County, California, Mr. A. B. Snyder, the owner, uncovered a well-defined ledge of gold quartz at a depth of six feet. Mr. Snyder decided to do some mining inside of his garage. A windlass was installed and a shaft sunk, and in a short time some beautiful gold specimens were extracted from below the garage floor. The shaft was sunk to a depth of sixty feet, and so much water was encountered that an electric pump was installed in the shaft to keep the water out.

During the mining operations several tons of gold quartz were taken out of the shaft and drifts under the garage. This was crushed and milled in a nearby stampmill. The quartz gave returns of $137.50 per ton.

After working the mine for a short time the waste dirt taken out accumulated in a large pile which extended the full length of the floor inside the building, leaving little room for automobiles. Mr. Snyder decided he had mined enough and shut down. A local gold-mining company then purchased the mineral rights under the garage and are now working the ledge through their mine. Because of its discovery in the Grass Valley Garage, the ledge is known to mining men as the "Garage Ledge."

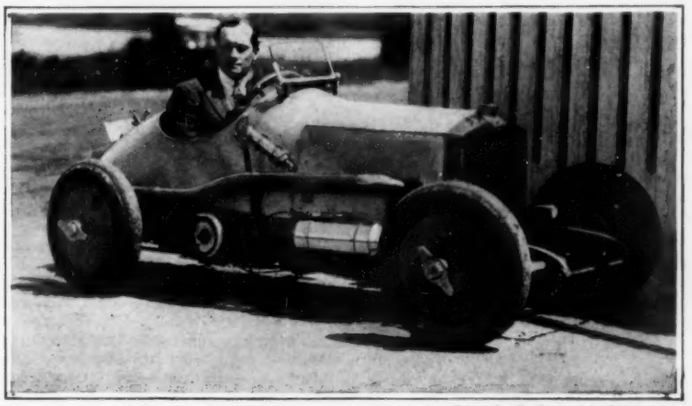


A sixty-foot shaft was sunk down below this garage floor in order to mine a ledge of gold quartz

The Miniature Automobile — An Odd Use for Airplane Parts

AN excellent little racing car can be made from a collection of odds and ends, as proved by the diminutive racer owned by Mr. Robert Breese of New York City. This little racer has attracted no end of attention wherever it has been shown.

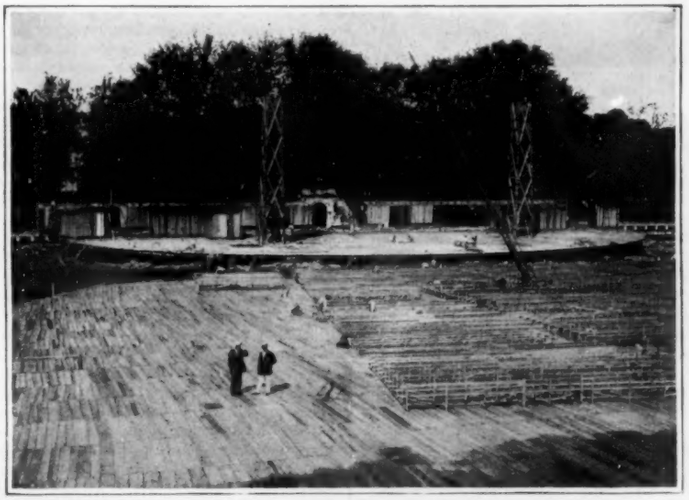
It appears that Mr. Breese constructed his little racer while stationed at one of the Army flying fields. A discarded motorcycle twin-cylinder engine, four airplane wheels and tires, an airplane windshield, and a collection of other miscellaneous airplane and motorcycle parts found their way into this unique racer. That the racer is something more than a toy is evinced by the fact that Mr. Breese has been using it steadily for the past two years. The little car makes close on to 50 miles per hour, and because of its low center of gravity there is virtually no danger of spilling. So the driver takes pleasure in furnishing his audience with thrills by turning corners at a high rate of speed, with a resultant side slip which would mean almost certain disaster to the usual racing cars operating under similar conditions.



Many automobile, airplane and motorcycle parts found their way into this diminutive racer

A Theater to Order

THE notion of a great public pageant involving a performance of some composition either written expressly for the occasion or selected from the classics because of its appropriateness is not particularly new; but when it was decided to give Verdi's great opera "Aida" in Milan on this basis the project called for something rather more ambitious than such a scheme usually involves. The fact of the matter was, there was no suitable location for the performance in existence, so the management of the spectacle was obliged to undertake the construction of one. It was decided that anything worth doing at all was worth doing well, and that a permanent open-air theater of imposing proportions was the only thing that would really justify the effort. So we have the rather unusual feature of such an arena being built to order for a single occasion—none the less built to order through the fact that it will remain standing and serve for general purposes after its special mission is discharged. We are not informed as to its dimensions, but the view herewith indicates very clearly that it is of most respectable proportions.



The open-air theatre at Milan, constructed especially for a commemoration performance of "Aida"

Transforming Explosives Into Fertilizers

MANY standard explosives contain large amounts of nitrogen especially in the form of nitrate of ammonia. The Italian Government some time ago requested Professor F. Garelli of Turin to undertake experiments with a view to transforming such explosives into harmless fertilizers, suitable for delivery to agriculturists. Nitrate of ammonia is very soluble in water. Professor Garelli, therefore, added a definite quantity of water to the explosives and allowed the mixture to settle in special basins. He thus obtained a dense solution of nitrate of ammonia readily separated by decantation. With this solution he then mixed powdered peat, the mixture being easily and rapidly dried. He thus obtained a fertilizer which he calls "nitrated peat" which has the following composition: water 17.8 per cent, ash 18.8 per cent, nitrate of ammonia 42.8 per cent, organic matter 20.6 per cent.

The fertilizer is a dark powder containing 16.4 per cent of nitrogen (7.5 per cent in the nitric form, 7.5 per cent in the form of ammonia and 1.4 per cent of organic nitrogen), plus 0.06 per cent of phosphoric anhydride and 1.8 per cent of potash. As will be seen its composition is analogous, therefore, to that of the nitrate of soda, which it can be used to replace in agriculture.

The fertilizing value of this nitrated peat was carefully determined by practical experiments made by Professor Gamacchio, director of the Provincial Chair of Agriculture at the University of Turin. The results of his tests in the district of Alba indicate that this new fertilizer is approximately equal in operation to nitrate of soda.

A Notable Experiment in Afforestation

ALMOST interesting experiment in afforestation has been successfully tried out during the last quarter of a century by Senor Francisco Piria, a prominent citizen of Montevideo, Uruguay to the south of us.

Having noted during a trip to Australia and Tasmania the great value of the Eucalyptus tree in its various species, not only for quick growth timber and fuel, but for stately ornament and aromatic shade and to diminish drought, the Senor determined to try them on a large scale in his own country. He bought about a million young trees, which he set out on a tract of barren land at a spot on the South Atlantic coast about fifty miles east of Montevideo. These were planted on the beach, in the sand, in a place that was not forest land at all.

The young trees took hold and thrived amazingly well, others were added, and at the present time there are something over three million trees, chiefly eucalyptus, in the plantation. The Senor figures that these trees, as fuel merely, increase in value at the rate of fifty cents gold per tree per year, that is about a million and a half dollars increase in the value of his tree investments each year.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Slot machine for calling a taxi

Calling a Cab by Slot Machine

WE are quite accustomed to purchasing our chewing gum from a vending machine; the automatic restaurant has introduced us to an unexpected variety of mechanical peddlers of liquid as well as of solid food; it is not even a totally new experience to many of us to buy a newspaper from an automaton or pay our street-car fare to such a device. The pay-station telephone has been on a slot machine basis in many of our cities for a long time now; and even when we put in a call for the fire apparatus we apply the slot-machine principle, divorced from the actual presence of a slot. It is as yet reserved to the dwellers in the German city of Hamburg, however, to exercise the privilege of calling the taxicab by use of a slot machine. Our illustration shows how it is done and what the machine looks like. You simply drop a coin in the slot and presently the desired taxi arrives on the spot. Whether your coin is deducted from your fare does not appear—it might reasonably be pleaded that it is worth a little extra to have the taxi wherever you may happen to be.

A Cigarette Tray with a Snuffer

CIGARETTE trays are now provided with snuffers for putting out smoldering cigarettes. After the smoker has finished his smoke it is pushed into the small tube on the side of the tray which snuffs it out. Fire risk is lessened, and no odor of a lingering smoke remains to disturb the anti-smokers.

A snuffer for the cigarette tray

Subsidies to Purchasers of Farm Tractors in France

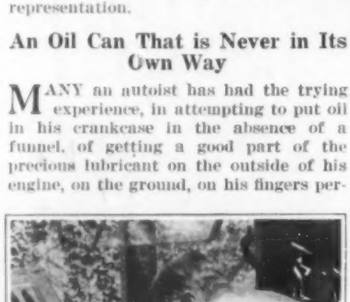
AGRICULTURISTS in the La Rochelle consular district, which has numerous large farm areas adapted to mechanical culture, are interested in the recent Government announcement of subsidies to be given to agricultural societies or groups of cultivators purchasing farm tractors.

The law of 1915 which granted subsidies of 33 1/3 per cent, and that of 1917, giving 50 per cent of the cost to buyers of tractors, were war measures taken to assist in assuring production of food supplies, and funds for this purpose placed at the disposal of the Minister of Agriculture are no longer available. A decision has now been reached continuing the assistance to the extent of 25 per cent of the cost for tractors built in France and 10 per cent for those imported from foreign countries. Conditions of the grant are the employment of tractors under 25 horse-power for three years and those of over 50 horse-power for five years, and that tractors of from 25 to 50 horse-power shall be used on at least three different properties and over 50 horse-power by at least five to insure wide use.

Representatives of several American concerns manufacturing farm tractors are now in France making a survey of conditions and securing connections for representation.

An Oil Can That is Never in Its Own Way

MANY an autoist has had the trying experience, in attempting to put oil in his crankcase in the absence of a funnel, of getting a good part of the precious lubricant on the outside of his engine, on the ground, on his fingers perhaps—everywhere in the world, it must sometimes seem, except down the opening of the breather. One way to remedy this would be to induce the car manufacturers to put the breather in a somewhat more easily accessible spot—but this is a remedy which the average automobilist is hardly in a position to apply. So one of the big oil refiners has come to his rescue with an "easy pour" can for oil. The trick consists in the very simple expedient of an offset spout; instead of being centered over the can, so that no matter what side we attack the problem from the rim of the cylindrical portion of the container is in our way, this spout is off at one side, flush with the wall of the can itself. It is equally easy to get this spout into contact with the breather and to complete the operation of pouring without a mishap.



The easy pouring oil can in use

A New Portable Grinder

A LIGHT, economical bench or portable electric grinder which is particularly intended for use as a valve facer has been introduced by a California manufacturer. With an extra hub and wheel this grinder can be used for grinding small tools such as drills and chisels. The 1/12 horse-power motor is mounted upon a rigid base and power is supplied from any convenient plug or socket. In grinding the valve is moved back and forth across the face of the wheel, which keeps the wheel true, the valve being revolved during grinding. The arm is graduated from 30 to 60 degrees. Valves may be easily changed in the carriage as they are held in V's with a spring and the V's can be moved anywhere along the horizontal shaft to make allowance for worn places on the valve stem.

A familiar makeshift reduced to a production basis

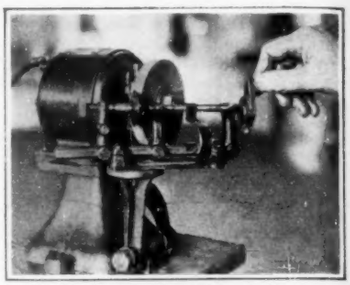
A Wire Brace for the Crippled Chair

YES, we have all done this trick to make old chairs last longer, but now someone has patented the idea and made the wire supports in a way that is much easier to use. This adjustable chair brace comes in pairs. Each end has a loop, while at the opposite end is a smaller loop into which a screw is put and placed in the bottom of the chair. With the end of a screw driver or a pair of pliers, all the slack can be taken up by twisting.

Car Strike and Motor Buses

TWENTY-TWO rubber companies in Akron confronted with the problem of transporting 65,000 employes to and from work during the recent street car strike operated several hundred motor trucks on schedules that enabled them to move the large force of people without loss of time. Motor trucks and buses owned by one of these companies hauled approximately 4,000 people during each of the shifts at 7 a. m., 3:30 p. m., and 12 o'clock midnight. In addition they handled the crowds from the general office and factory office at 4:30 p. m. It was estimated that the buses of one firm hauled 20,000 people a day.

One of the innovations made in bus design was a six-wheel motor vehicle. Equipped with a special street car body it is probably the largest motor bus in America. With the pay-as-you-enter arrangement, upholstered seats and complete equipment, it seats 44 passengers. Including standing room, it will accommodate approximately 90 passengers comfortably. The tandem rear axle arrangement made possible greater traction and easier riding and enabled the huge bus to carry enormous loads.

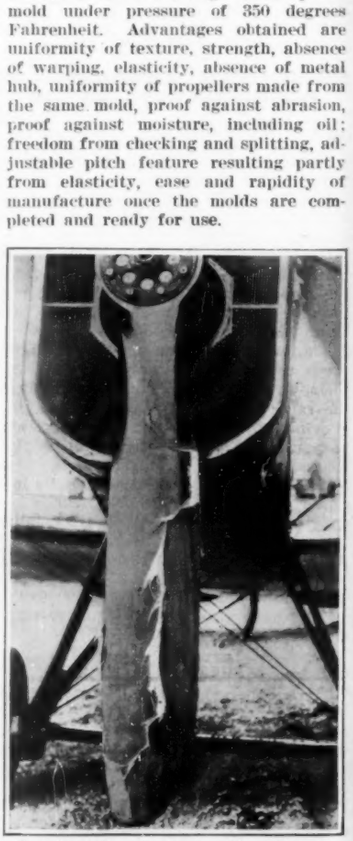


The latest portable grinder

Bakelite for Airplane Propellers

THE use of bakelite for airplane propellers has been undergoing severe tests by the Army Air Service. The laminated walnut propellers have proved very susceptible to wind and storms even in short flights of from eight to twelve hours' duration in spite of the fact that the propellers were further strengthened with doped fabric such as is used for airplane wings and that laminated walnut is the strongest known wood.

The results obtained with bakelite have been reported to be very satisfactory. Several designs of propellers have been used but the micarta has been the most serviceable. The propellers are made by coating sheets of duck with bakelite, then pressing five or six of the sheets tightly together to form a board that is sawed out in the shape of a propeller lamination just as wood laminations are cut. The bakelite is then molded to an exact angle in a special mold under pressure of 350 degrees Fahrenheit. Advantages obtained are uniformity of texture, strength, absence of warping, elasticity, absence of metal hub, uniformity of propellers made from the same mold, proof against abrasion, proof against moisture, including oil; freedom from checking and splitting, adjustable pitch feature resulting partly from elasticity, ease and rapidity of manufacture once the molds are completed and ready for use.



Laminated walnut propeller after a trial against wind and storm

Doing Away with the Loafing Charge

(*Continued from page 24*)

the truck body and raise it to whatever story is desired.

The loading and unloading of bulky and yet not extremely heavy packages is greatly facilitated by using drop sides or removable sides. If the body is used for regular routine delivery work, it is apparent that the drop side will save time as it can be handled more easily than the completely removable side assembly. For example, a bale of cotton weighs approximately 500 pounds. Hoisting this over the side of a motor truck can be easily accomplished by a couple of reasonably strong men provided the lift is not too high.

Cranes of various kinds are also of considerable value on trucks handling heavy materials. For example, in a truck delivering materials in barrels, it is possible to make the work easy for the driver so that it will not be necessary to carry a helper. This is done by fitting a simple, hand-operated crane to one side of the truck body at the rear end, provided with a swinging arm, which has a winch so that it can swing to any central point on the truck body and after the barrel is gripped by the hooks, the arm may be swung around and the barrel swung clear of the truck platform.

The best loading mechanism, where it is practical to use it, is a portable wagon- or truck-loader which will eliminate a large amount of hand shoveling in handling materials such as coal, gravel, etc., that is usually stored in piles. For example, by the use of a portable wagon-loader, it is possible to unload gondola cars of the hopper or dump-bottom type very easily, inasmuch as the car is run along a section of track and the load dumped in a pile. The portable wagon-loader, which in its simplest form consists of an adjustable bucket-conveyor mechanism mounted on wheels, carries the coal to a chute at the top which transfers it into the truck body. In another form of scoop conveyor, the material is lifted from the car interior by a chain conveyor operated by any suitable crane rigging which lifts the coal into a large, hopper-bottom steel bin. This is supported on a trestle work of sufficient height so that a motor truck can be driven under it to be loaded.

Some forms have belts instead of metal bucket conveyors. In the belt form, two forms of cleats are provided depending upon the kind of material to be lifted. The usual speed of a conveyor belt is about 170 feet per minute. When the belt is fitted with low cleats it is suitable for carrying material such as bricks, coke, coal in large sizes, bags, boxes, paving blocks, tile and similar materials. When the belt is provided with high cleats it can be used for handling material such as fruits and vegetables, smaller sizes of coal, ashes, crushed stone and other substances of similar nature.

Perhaps the most common form of special body that has received general application and which is adapted for a wide range of industrial use is the rear-dumping body having hydraulic or mechanical hoisting mechanism. These dumping bodies are made in a wide variety of different patterns and differ in design according to the requirements of the people using them. Some of these bodies are centrally pivoted on the longitudinal axis and may be tilted so the load is discharged from one side. Others, which have been designed for use with trailers, are bottom dumped. Evidently the bottom discharge construction would not always be as practical on a motor truck chassis as it is on a trailer because of the parts of the truck mechanism that are carried on the frame underneath the body.

The usual form of dumping body is pivoted near the back end and lifts up so its load can be discharged through the tail gate at the rear. It is possible to make a body of this type with a hopper-like back so that it is not necessary to use a tail gate. Automatic dumping bodies are designs in which the material is carried in a box having a sloping bottom so that it will discharge without tilting the body. This method of construction is not always advisable because there is considerable loss in the available cubical contents of the body. Some forms of bodies that are used in the coal industry which provide automatic dumping features are so mounted that they may be elevated so that the load will be raised six or eight feet higher than the ground.

Hoisting mechanism is of two general forms: those in which the body is lifted by arms actuated through gearing which may be turned by a hand crank by man power or through a power take-off by the engine, and that type in which the work is done by hydraulic means. The mechanism employing reduction gearing is merely an improvement on the old type that was formerly hand operated and provided as equipment on horse-drawn vehicles.

The present hydraulic type of hoist would not be practical except on motor trucks; they cannot be operated very well by hand, for they require motor power to turn the pump fast enough to lift the ram in a reasonable length of time.

An important consideration in the designing of all dumping bodies, whether these are to be of the automatic type, or that form in which the wagon body is raised, is the angle of slide. This means the minimum angle with the horizontal at which material will move by its own weight. Naturally this angle is altered by the nature of the material and the type of body construction. Authorities state that an angle of inclination of forty-five degrees will be ample for dumping any of the materials usually handled in dump bodies.

In certain classes of contracting work and around industrial plants, portable lifting cranes and derricks have been installed on standard motor truck chassis. Some of these derrick mechanisms have a capacity for lifting six or seven tons, the load being raised by block and tackle arrangement which is operated by a motor-driven winch or windlass carried behind the driver's seat and operated from the truck engine.

The reason a separate engine is used on some of these derricks rather than employing the truck power plant is that the amount of power required for operating the derrick is considerably less than that delivered by the motor truck power plant.

Other trucks have been designed that use a traveling telpher which is provided instead of the usual form of derrick boom. These are suitable for lifting very heavy loads and are simpler in construction than the derrick is. Their use is limited, however, as they can only lift material from the truck body to the immediate rear of the truck or lift it from the ground back of the truck into the body. In order to permit mechanism of this kind to handle heavy goods, a pair of substantial screw jacks is carried by the rear of the chassis. These are dropped down to the ground and adjusted to support the rear end of the frame and relieve the truck springs and tires of the heavy load. When the jacks are down, a rigid platform is obtained.

Aircraft for Pleasure

(*Continued from page 25*)

The Longhead motor weighs approximately 90 pounds, is water cooled, and has two horizontally opposed cylinders with a bore of 3⅝ inches and a stroke of 4½ inches. There are two independent magnetos; and two high pressure gear-type oil pumps. The radiator, as noted above, is mounted in a novel position, immediately under the fuselage—the most log-

(*Continued on page 37*)

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

BRAKE FOR AIRPLANES.—W. E. KARNES, 58 Midland Ave., Arlington, N. J. The main object of the invention is to quickly reduce the speed of an airplane in order to avoid collision while in the air, or to bring the machine to a stop after having traveled only a very short distance along the ground; the device for accomplishing this result is secured to the tail portion of the fuselage and is easily operated by the aviator and is at all times under his control.

METAL CONSTRUCTION.—D. J. MOONEY, c/o The Steel Wing Co., Ltd., 48a Gillingham St., London, S. W., 1, England. This invention relates to airplane construction and means for joining the spars or longerons with ribs at an angle thereto, an object being to provide a construction and arrangement of saddle which insures a rigid connection of the parts and which maintains the continuity of the rib shape, and structural work to constitute the skeleton or support of the planes. A further object is to provide a construction embodying maximum strength, but which is relatively light in weight.

Pertaining to Apparel

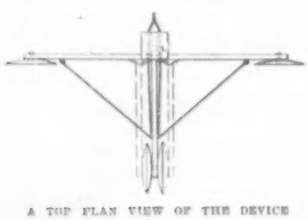
CORSET.—S. J. NEWMAN, Box 1716, New Haven, Conn. The object of this invention is to provide a corset of the front lace type with a cut-away front section in part of the garment for presenting a proper supporting structure while allowing an unusual amount of freedom adjacent and above the waist line. A further object is to provide a corset with an elastic vest structure at the front where the upper part of the front is cut away.

COMBINATION OVERALLS.—M. M. HORN, Eau Claire Natl. Bank Bldg., Eau Claire, Wis. This invention relates to a combination overalls. The garment may be worn conveniently in four different ways, to wit: As a regular overall with suspenders and bib, as a hip overall without bib, as a complete union suit or union overalls, or as an overall with bib and jacket without suspenders; the jacket and trousers are separate and means is provided to adjustably connect the same.

CORSET.—S. J. NEWMAN, 43 Oak St., New Haven, Conn. This invention relates specifically to a front lace corset with an arrangement of elastics so that there will be appreciable openings there between, the same being associated with steel or whalebone pockets extending across the openings whereby the flesh cannot protrude through and whereby ventilation will be provided. The arrangement presents a cool construction of corset for use in summer.

Of Interest to Farmers

SCARECROW.—C. A. DAVIS, 526 S. Flower St., Los Angeles, Cal. Among the objects of the invention is to provide a scarecrow with movable arms which can be operated from a distance. A further object is to



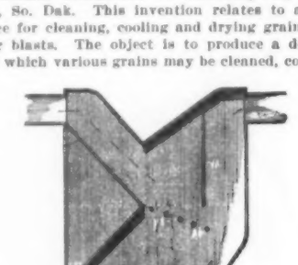
A TOP PLAN VIEW OF THE DEVICE

provide scarecrow embodying a support and a pair of movable arms operating cymbals to sound an alarm, and frighten away birds in fields, gardens and other places.

SEED PLANTING GAGE.—G. A. WARNECKE, 579 Fairview Ave., Brooklyn, N. Y. The invention relates more particularly to a device for planting seeds in small quantities. It is the prime object of the invention to provide a device by the use of which seeds may be properly placed with respect to each other and all planted at a single operation. Seeds of various sizes may be planted and the spaces between the seeds varied at will.

COMBINED CLAMP AND WHEEL GUARD FOR FARM WAGONS.—L. P. WELLS, Box 1, Gearing, Neb. The foremost object of the invention is to provide a device for keeping the front wheels of a farm wagon from wearing holes in the adjacent corners of the wagon box in making turns, this device being in the nature of a metallic guard to be applied to the places where the wear usually comes, it at the same time including a clamp for holding the upper board of the wagon box side down.

GRAIN CLEANER.—C. METTLER, Sr., Menno, So. Dak. This invention relates to a device for cleaning, cooling and drying grains by air blasts. The object is to produce a device by which various grains may be cleaned, cooled,



A VERTICAL LONGITUDINAL SECTION OF THE CLEANER

dried and otherwise improved, which is simple in construction, easy to make and carries no mechanical parts to get out of order, or require lubricating.

HAYRACK.—W. M. DE WITT, 632 Rockford St., Elkhart, Ind. The invention has for its object to provide a rack of the character specified, having fastened at the center thereof an auxiliary rake hinged to the main rake to tip forwardly to carry the rear part of the load to the front part of the main rack.

IRRIGATION DAM.—H. J. CULLY, 923 19th St., N. W., Washington, D. C. The invention has for its object to provide a dam of the character specified wherein the dam is arranged to be displaced at the end of a predetermined time by drip controlled machanism to permit the water to flow freely after a predetermined time.

Of General Interest

CURING HOUSE FOR SWEET POTATOES.—E. J. ILES and O. L. HASTING, Alexander, La. This invention relates generally to storing and curing devices for vegetables, and more particularly to a sweet potatoe curing house by means of which a desired degree of heat may be steadily maintained and thoroughly circulated, and a further object is the provision of a construction which is readily adaptable to different localities under different prevailing conditions.

BOTTLE WARMER AND STERILIZER.—W. E. LAWSON and W. R. SMITH, address Lawson-Smith Mfg. Co., Rahway, N. J. The invention relates to means for warming nursing bottles and consists of a container presenting a body and a broadened bottom portion, said bottom portion being adapted to hold a quantity of water and the container being adapted to receive the bottle to be warmed by steam generated by the heating of the water. An object is to provide for supporting the bottle without contact with the bottom of the warmer, thereby avoiding danger of cracking the bottle.

DOLLS' EYE.—O. E. DENIVELLE, c/o Lewis Amberg & Son, 375 Broadway, New York, N. Y. This invention relates to dolls' eyes of the sleeping type, and provided with eyelashes; its object is to provide a doll's eye arranged with eyelashes, appearing exceedingly natural when the eyes are in open or in sleeping position. Another object is to permit of securely holding the eyelashes in place and to allow of cheaply manufacturing such dolls' eyes.

HAIR WAVER.—M. MULLER, c/o Wm. Kaufman, 1482 Broadway, New York, N. Y. The object of the invention is to provide a device for waving natural hair on the head, whereby hair is permanently waved in a sidewise direction to cause the hair to be flat on the head of the wearer in perfect Marcel wave fashion. Another object is to prevent the hair from becoming kinky or curly, and to prevent the hair from becoming overheated and injured during the process of waving.

CROW'S NEST FOR SHIPS.—A. E. DE SAVE, Grand Hotel, Mexico City, Mexico. This invention has for its object to provide a crow's nest which is enclosed to afford protection for the lookout and which is supported by a universal joint on a boom which extends from a mast on a ship. The crow's nest is provided with periscopes, telegraph and other means for communicating with the bridge and gun crews, and may also be provided with an electric heater for winter and fans for summer.

FLOUR SIFTER.—C. O. NEPSTAD, Watford City, N. D. An object of the invention is to provide means for agitating the flour to cause the same to move through a screen and which is so constructed that the flour can be moved backwardly and forwardly through the screen until it is sifted to suit conditions. A further object is to provide a device which is capable of a wide variety of use.

BELT BUCKLE.—W. G. AHRENDT, 105 Rose Terrace, Newark, N. J. The invention relates more particularly to a type of belt buckle in which a gripping element is arranged to have sliding movement longitudinally of the buckle for effecting a gripping action on the belt. A more specific object being to provide a buckle of simple form, possessing strength and presenting an attractive appearance.

ENVELOP.—J. S. CRATE, c/o Humble Oil & Refining Co., Houston, Texas. Among the objects of this invention is to provide an envelop more particularly designed for inter-office use, having means for indicating the destination of the envelop to any of a series of persons or locations. A further object is to provide an envelop having a series of spaces thereon with a separable indicator adapted to be located in any of said spaces to indicate the destination of the envelop.

CLOTHES DRIER.—P. D. RIORDAN, 131 E. 86th St., New York, N. Y. This invention has been granted two patents on clothes driers, appropriate for city or suburban houses. The first invention has for its object to provide a drier of the outrigger type wherein the frame when in operation may be positioned to extend entirely beyond a window sash, and when not in use may be folded against the window frame without requiring that the operator leave the building, making it possible to dispense with the lines usually found in the yards of city dwellings. The object of the second invention is to provide a drier for use on lawns, verandas and similar places; this construction is such that it may be stored in a very small space when not in use, yet when in operative position will support a number of articles of clothing.

TOBACCO BITER.—L. E. ASHENFELTER Supply Co., 32nd Infantry, Camp Kearney, Cal. This invention relates to an improvement in tobacco biters, and has for its object to provide a device of the character specified for tobacco chewers' use adapted to be connected with the plug, for severing when desired a piece of tobacco of suitable size for a chew.

ASH TRAY.—A. E. LIEBNER, c/o Chas. Miller, 148 E. 92nd St., New York, N. Y. Among the objects of the invention is to provide a construction wherein the tray is supported so as to be readily clamped in a number of different positions while allowing a free pivotal movement in a horizontal direction as occasion may demand. Another object is to provide a tray in which a comparatively light form of bracket may be utilized, and an interlocking supporting arm for connecting the bowl to the bracket.

Hardware and Tools

CUTTING TOOL.—L. G. MORRIS, 1015 Park Ave., New York, N. Y. The invention relates to cutting tools particularly adapted for removing the skin from the animal. An object is to provide a device in which the maximum amount of power may be transmitted without undue heating under varying degrees of pressure with which the device is applied to the carcass from which the skin is to be removed. The cutter is so supported that it may be readily and quickly moved during the cutting operation.

CIRCULAR SAW.—A. MCCURRIER, 315 E. 3rd St., Aberdeen, Wash. The general object of the invention is to provide a circular saw for log sawing, shingle sawing, etc., so constructed as to have increased stability against distorting strains and tendencies set up in the saw when in action, whereby the saw will maintain its plane and promote economy by producing a kerf of the minimum width. A further object is to provide a saw with a detachable rim portion, permitting renewal without the necessity of discarding the complete saw.

METER SUPPORT.—L. MCNUTT, c/o McNutt Meter Box Co., Brazil, Ind. This invention pertains more particularly to connecting means for mounting a meter for ascertaining the amount of flow of material through vertical pipes. The prime object is to provide a support by means of which the meter may be readily attached to or detached from the line in which it is used.

TRAP.—J. MANNING, Sr., Marathon, Texas. The object of the invention is to provide mechanism in connection with spring traps, which is controlled by the closing of the trap, for sweeping the jaws free from obstruction which might hinder the proper closing, and for spacing the jaws, when closed slightly so that the bones of the leg of an animal caught will not be crushed.

COTTER PIN REMOVER.—B. TWETO, 1242 Jackson St., Missoula, Mont. Among the objects of the invention is to provide a device of the character stated which can be operated by one hand and which will exert a minimum of leverage to insure an easy withdrawal of the cotter, the provision of a device which is neat in appearance and strong and durable in use.

SCREW-DRIVER.—F. A. HOLT, 360 Highland Ave., Arlington, N. J. The invention relates to means for connecting the tool with the handle. An object is to provide a tool holding pin which also functions as a means for holding the tool-receiving nipple against rotary movement in the handle, yet which will permit the ready removal of the tool notwithstanding the strain and stresses which may be put upon the same.

WOOD SPLITTING MEANS.—O. STAUB, Nicolaus, Cal. This invention has for its object to provide a wood splitting tool consisting of a wedge having longitudinal ribs on opposite sides, the opposite ribs merging into each other beyond the front edge of the wedge constituting separate entering points in advance of the wedge body in the form of separate wedge-shaped members.

GROMET.—S. ROBINSON, 510 9th Ave., Astoria, L. I., N. Y. The invention relates to packing devices and particularly to what is known as a gromet, the object being to provide a construction which will effectively prevent leaks around a bolt when the nut is properly tightened. Another object is to provide a gromet with radially positioned flanges and two laterally positioned flanges for engaging the nut or washer and the article clamped by the bolt.

LOCK SWITCH.—F. T. EAGLE, 2099 8th Ave., New York, N. Y. The object of the invention is to provide a lock switch more especially designed for use in the ignition system of an internal combustion engine used on an automobile or similar power-driven vehicle and arranged to enable the driver of the vehicle to render the ignition system inoperative. Another object is to permit of readily installing the lock without requiring practically any changes in the ignition system.

COOKING UTENSIL.—F. EIDT, 38 West St., West New Brighton, N. Y. The invention relates to a utensil for use with a frying pan and more particularly to a utensil adapted to be employed with a frying pan when cooking eggs, for example, whereby the cooked article may be lifted from the frying pan and the grease permitted to drain in the lifting.

Heating and Lighting

FLUID HEATER.—J. BRAUNSTEIN, 76 W. 114th St., New York, N. Y. This invention aims more particularly to provide a device which shall utilize heat which is normally wasted, for the purpose of heating water. A further object is the provision of a heater which may be interposed in the flue of a burner, stove, or other heating plant, which is adapted to absorb all of the heat possible from the products of combustion coming in contact with the same and to transmit such heat to the fluid.

Machines and Mechanical Devices

CLOTHES WASHING MACHINE.—R. ELCOCK, Johannesburg, Transvaal, South Africa.

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Aircraft for Pleasure

(*Continued from page 35*)

ical place for it. Fuel consumption is one gallon, and oil one-half pint per hour. The landing gear is of the usual type with a factor of safety of over 10 to 1. There are only five wires on each side of the body—three flying, one landing and one drift, all being neatly faired to lessen head resistance. A special feature which will commend itself to all private owners is the patented wing-folding device reducing the housing space required to such an extent that any good garage is a suitable hangar.

Another small machine intended primarily for pleasure purposes is the "Butterfly" monoplane, built by the L. W. F. organization of College Point, N. Y. The body of this machine is monocoque, ending in the vertical knife-edge common to most European machines. A somewhat novel feature for a monoplane is that there is no cabane or structure above the fuselage to hold the wings in place by means of wire when the machine is on the ground. The latter are kept rigid by two diagonally placed wooden braces on each side, placed parallel, and running from either end of the chassis struts to about the center of pressure of the planes. There is also a small vertical strut in between to give additional strength. Wire cables prevent side sway.

In passenger machines there are several models on the market, but they are all naturally more expensive both in first cost and in upkeep than the single-seaters. Very powerful, and consequently, heavy motors are not really necessary in a pleasure craft where speed is not a first desideratum as in warfare, or lifting capacity would be in a commercial machine. If a properly designed body and camber of wing allows a small single-seater to be safely flown with a 25-horsepower engine, it follows that a two-seater requires but little more power, certainly less than double, if the passenger is properly seated as near the center of gravity as possible, a feature often overlooked. Weight distribution is a more important factor than is generally recognized.

In conclusion one may remark that there is no reason why the airplane should not become as universally popular in the near future as the automobile. Standardized types built on a quantity output scale should cost no more than the average motor car.

Fifty Motor Truck Opinions

(*Continued from page 26*)

Yet it is also true that there is opportunity for standardization, namely, in the chassis. One manufacturer suggests that truck builders should come to a standard dimension from dash board to back of seat box and for the width of two or three-men cabs, so that the body builders could make up cabs in quantities and bring down their costs, thus effecting a saving to motor truck builders which could be passed on to the buyer. This would certainly be a step forward in production.

Are motor truck bodies too high? Perhaps there is room for thought in that question, for a leading engineer states that in his belief motor truck bodies will have to be made narrower or wheel housings will have to be included in the bodies in order to allow the platform of the usual body to be nearer the ground.

Saving a Few Pounds Here and There

Pound by pound the motor truck builders are shaving down their truck weights in order to secure more economical operation, consistent with long wearing qualities and efficient service. As an instance, one builder has just put into production a tubular type propeller shaft which reduces the total weight of his truck just 32 pounds. In his quest for lighter weight this same manufacturer, some time ago, eliminated torque and radius rods as he found that the rear springs could be made to do their work better and at the same time eliminate between 400 and 700 pounds of weight.

Another builder has reduced the unsprung weight of his car 200 pounds by using pressed steel axle housings instead of malleable iron or cast steel. On the one hand designers are simplifying and eliminating parts here and there to reduce weight, while on the other the engineers are turning to lighter alloys and metals. Aluminum, we find, is being used in moderation. It is employed by some for crank cases and underpans in order to reduce motor weight. Regarding structural parts, drop forgings and pressed steel parts are gradually replacing heavier castings. Heavy alloy steel is used in parts having to resist greater strains, but more from a standpoint of increased strength than a reduction of weight. Of course, there is a limit to how light a motor truck can be made, consistent with efficiency. A motor truck must have enough weight to get traction, that's certain.

The subject of weight introduces that of tires, which in the case of motor trucks looms up quite big in view of the keen rivalry between the solid and the pneumatic types. The consensus of opinion is that the use of the pneumatic tire on trucks has opened large new fields which could not be approached with the solid-tired vehicle. The pneumatic tire permits higher speed with heavy loads on good roads, and is also particularly adapted to soft roads since it does not cut into them as deeply as the solid type.

Pneumatic or Solid Tires?

Automotive authorities do not look forward to any radical changes in the tire situation, except that cushion tires are likely to become more common. As for the choice between pneumatic and solid tires, this is largely a question of circumstances. Some authorities recommend solid tires for use on the larger motor trucks employed for city service, and pneumatic tires on the smaller trucks and up to 2½-ton capacity. For country use, especially over roads that leave much to be desired in the way of smoothness, pneumatic tires are recommended.

Obviously, this all means, when boiled down to essentials, that the pneumatic tire has proved its worth in the past few years since its introduction. Motor truck builders appear to be quite enthusiastic over the pneumatic tire, which offers greater resiliency and therefore permits of greater speed on the one hand, and better protection to the vital parts of the truck. Furthermore, better traction can be obtained. All these factors mean much in the way of lowered transportation costs. Again, pneumatic tires prolong the life of any truck and save on repairs. However, as one authority points out, their maintenance cost—and they cost considerably more per mile—has caused some users to discard them. It seems as though the solid tire and the pneumatic tire each have their proper field, and sooner or later they will settle down in those fields with little or no conflicting opinions regarding their most efficient applications.

What of the Future?

The motor truck is no longer an experiment. Its field is pretty well defined. It has solved the problem of short hauls and is the best known means or radii for connecting railroad diameters, as one authority puts it. Up to 150 miles, the motor truck is held to be the most economical form of rapid transportation. Its place in our transportation scheme is between the horse and the railroad; but it will be some time before it displaces entirely the former.

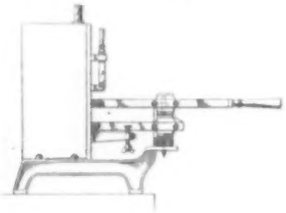
As for novel applications, aside from the motor truck's regular use as a short-haul transport, there appears to be no limit. Today we find motor trucks equipped with flanged wheels doing duty on branch line railways and small rail-

RECENTLY PATENTED INVENTIONS

(*Continued from page 36*)

A purpose of the invention is to provide a machine in which the liquid and clothes are agitated back and forth without substantial lifting, thereby making the machine light to work. Another object is to cause the liquid to flow relatively to, and through, the fabrics by mechanical means, and to subject the clothes to combined squeezing and rubbing and to a vibratory movement.

BRAZING MACHINE.—R. J. PECK, 1916 Staples Ave., Key West, Fla. The invention relates to a brazing machine more particularly for use in brazing the ends of metal such as



A SIDE VIEW PARTLY IN SECTION

a band saw, together. An object is to provide a machine which is compact and capable of being disassembled so as to occupy a minimum of space, and so constructed as to employ the conventional A. C. 110 V. current, so that it may be operated wherever a lighting fixture is available.

AUTOMATIC GREASE CUP.—W. E. RICH, 5 2nd Ave., New York, N. Y. This invention pertains more particularly to lubricators of the force feed follower type. The primary object is to construct a device of this character in such a manner that the same may be carried by the moving parts of machinery without affecting the operation of the latter. A further object is to provide a spring for operating the follower and also to provide in combination with the spring means for adjusting the tension thereof.

PERMUTATION VALVE.—H. QUINN, 8014 Fort Hamilton Parkway, Brooklyn, N. Y. The invention relates to a permutation lock for controlling the flow of a fluid through a pipe in such manner as to render it practically impossible for any unauthorized person to cause or permit the flow of a liquid. The lock is in the form of a rotatable valve plug having facilities for setting the same for opening of the valve at any desired points, assuming that it be desirable to change the combination from time to time.

BALL BEARINGS.—A. GOLDEN, 10 S. Park Ave., Arverne, L. I., N. Y. The object of the invention is to provide a ball bearing arranged to provide sufficient bearing surface to sustain the load without danger of injury to the raceway of the bearings and at the same time prevent binding of the balls in the raceway, and provide means for keeping the ball bearings lubricated.

GANGPLANK.—L. W. LANNING, Winona, Wash. The invention has for its object to provide mechanism in connection with a gangplank such as are used for permitting passage of truck loads of freight, for registering the passage of the trucks in one direction, controlled by the passage of the truck in the said direction, and not controlled to register by the passage of the truck in the reverse direction.

ELECTRICAL COIN DELIVERY MACHINE.—C. MCDERMOTT, Freehold, N. J. An object of the invention is to provide a coin delivery machine for use in banks, merchandise establishments, and other places where silver coin is handled in making change transactions. It is a purpose to provide a coin delivery machine consisting primarily of a coin delivery unit electrically controlled by a key board unit so that the cashier or operator of the machine may be distant from the coin delivery unit.

TACKLE BLOCK.—G. HILGERS, Bothastraat 23 B Rotterdam, Netherlands. This invention relates to tackle blocks in which at least one of the pulleys has rigidly fixed to it a ratchet wheel adapted to be engaged by a spring-pressed pawl pivoted to the body of the block, the arrangement being such that the pulley is prevented from rotating in a lowering direction, a cord being so connected to the pawl that by pulling the same the pawl can be raised to free the pulley.

ROTARY STAMPING DEVICE.—J. MEREY, 2842 N. Maplewood Ave., Chicago, Ill. An object of the invention is to provide a stamping device for stamping letters, numerals and the like into metals. A further object is to provide a device with means for adjusting the die holding mechanism with respect to the articles to be stamped so that impressions of different characters can be neatly and quickly stamped, varying in size.

PISTON RING.—H. T. ANDREW, 395 9th Ave., W., Marion, Ohio. This invention has for its object to provide a ring of the character specified, which is easily placed or removed, consisting of sections each of which is a split ring, but so held with respect to each other that pressure cannot pass the ring by way of the splits in the sections.

SEPARATING APPARATUS.—E. L. MARSHALL, 328 London St., Portsmouth, Va. The invention relates particularly to a machine for separating peanuts. It is the purpose of the invention to provide an apparatus which is capable of completely and thoroughly separating the foreign substance from the peanuts, such separation being effected in the main by air blasts which are controlled to coöperate with the natural force of gravity.

PRESS FOR IMPRINTING AND DRYING MATRICES.—C. WINKLER, Berne, Switzerland. The object of this invention is to render the operation of said presses safer, easier and more effective than in existing presses so that the imprinting and drying of the matrices can be carried out in one operation. Moreover precaution is taken to prevent the form from being injured during the process.

ART OF LETTER-PRESS PRINTING.—C. WINKLER, Berne, Switzerland. The invention relates to a means for keeping the press and inking apparatus in proper condition by combined heating and cooling. The press comprising a former carrier adapted to be electrically heated, inking mechanism and means to circulate a cooling liquid through the ink distributing rolls against which the inking rollers bear.

AUTOMATIC SHUTTLE-STOP FOR LOOMS. T. F. LOFTUS and F. E. BRAZEAL, Box 271, Clifton Heights, Pa. The primary object of the invention is to prevent what is known as the "shuttle smash" or the breaking of the warp ends. Another object is to prevent damage to the mechanism and injury to the weaver in the event that two shuttles are caused to collide as a result of the weaver making the mistake in putting shuttles in the shuttle race at both sides of the loom; the invention provides for the automatic stopping of the loom.

ROLL CLEANING DEVICE.—A. H. WHITE, 4902 2nd Ave., Pittsburgh Pa. An object of this invention is to provide a roll which simultaneously cleans a pair of rolls of the type ordinarily employed in sheet metal rolling. A further object is to provide a device with a mounting which permits the cleaner to be moved longitudinally of the rolls and which permits any desired pressure to be had during the cleaning operation.

Medical Devices

DENTAL TOOL.—J. L. KELLY, Aeolian Bldg., 42nd St., New York, N. Y. The object of the invention is to provide a tooth polisher consisting of a handle, a conical metal socket, a polishing point composed of wood, and a shank on the point adapted to be forced into the socket, the shank having a plurality of contact points and between said contact points forming spaces between the shank and the socket.

SPINAL TRACTION CHAIR.—E. E. HOSMER, c/o Alcazar Hotel, Room 1112, 47 W. 22nd St., New York, N. Y. This invention relates generally to a surgical chair, and more especially to a chair known as a spinal traction chair which is particularly adapted to selectively stretch or extend different portions of the spine to separate the vertebra. One of the objects is to provide a chair of simple and rugged construction having means for obtaining adjustable movements between the devices and the seat of the chair.

ways, where the traffic does not warrant the operation of expensive steam trains. Motor trucks with suitable bodies are carrying tourists to the battle fronts of France. Many adventurous folk are traveling about the world in special cars mounted on motor truck chassis. In districts in which the sole business is the entertainment of summer guests and the period of such business does not extend over three months, de luxe bodies embodying Pullman car accommodations are now being mounted on trucks. Bodies similar to the present dining cars will follow shortly, connecting the isolated summer resorts with the main railroad routes.

X-Ray Tubes by the Hundreds

(*Continued from page 28*)

grinding. The rough anode head for the universal tube is formed from a sintered tungsten rod in a swaging machine, which is a nicely controlled high speed hammer used in this case to reduce, by successive operations, the diameter of the tungsten rod. The rod is heated to about 1,600 deg. C. in an atmosphere of hydrogen gas in an electric furnace, and is then rapidly passed through the swaging machine. In this operation the diameter of the rod is reduced 10 per cent. The rod is then reheated in the furnace and is ready for the next pair of swaging dies, which will again reduce its diameter by 10 per cent. When the rod is at the required diameter for the head of the anode, the end of the rod only is swaged down to form the taper and straight portion to which the molybdenum stem is attached. After rough grinding to approximate size and shape, the anode head and molybdenum stem are swaged together. The assembly is completed by the addition of an iron collar and a thin metal tube and the finished anode is then polished and very carefully cleaned.

The tungsten wire used in making the filament for the cathode is produced in a similar manner, the rod being reduced in size in the swaging machine until it may be hot-drawn to the required size of wire through diamond dies.

The anodes for radiator type tubes are made by casting specially purified (boronized) copper around a carefully cleaned tungsten disk in a vacuum. Copper and tungsten do not alloy with one another, but under the conditions employed, the melted copper wets the tungsten and adheres firmly to it when it solidifies. This process assures good thermal conductivity between the tungsten and the copper. The finished anode heads are electrically welded to a rod of copper which is to extend out through the anode arm of the tube and support the radiator. The platinum or alloy sleeve by means of which the seal between anode and glass is made is silver-soldered to the copper rod.

For all cathode filaments, tungsten wire of 0.0085 inch diameter is used. The first operation in making a filament spiral is the winding of the wire on a conical mandrel of special tungsten steel. Before the spiral is removed from its mandrel, it is given an anneal in hydrogen in an electric furnace. Conical spirals thus prepared are next clamped in molybdenum forms and heated in an electric furnace to a temperature of 1,600 deg. C. in an atmosphere of hydrogen gas. This forming of spirals is carried out to give three different shapes of filament which are necessary to produce the various sizes of focal spots.

The assembly of the cathode calls for very delicate manipulative work. Many of the parts are small, and in order to obtain the desired size and distribution of energy over the focal spot, the relative positions and shapes of these various parts must be nicely regulated. The tungsten terminals of the spirals in assembled cathodes are welded in place by arcing in hydrogen gas. One weld is made on the cathode cup and the other on the metal leading-in wire. This operation is carried out in an inverted glass bell jar through which is passing a stream of hydrogen.

All metal parts before being mounted in an X-ray tube are fired in a quartz tube vacuum furnace at 900 deg. C. for about an hour, and are allowed to cool down in a vacuum so as to prevent oxidization. The purpose of this firing is to render the parts perfectly clean and to remove partially the occluded gases and thus reduce the time required in the exhaust of the tube.

The bulbs and glass parts used in the tube are blown in molds at the glass factory and are therefore of uniform shape and quality. The operation of assembling these glass parts and the metal parts prepared is carried on by girls with the aid of glass-blowing machines of ingenious design. These machines are essentially lathes in which the two glass parts to be joined are clamped in separate chucks which are geared together so as to rotate at the same speed. Fires are provided for melting the glass, and compressed air, controlled by valves, for blowing.

The Coolidge X-ray tube requires a very high degree of vacuum for successful operation, approximately one ten-millionth of an atmosphere. In order to obtain this high vacuum, an elaborate exhaust system is necessary. As will be noted in the accompanying sketch, this consists of a series of three mechanical pumps, one condensation pump, and a trap surrounded by liquid air.

The X-ray tube to be exhausted is sealed directly to the glass tube coming from the liquid air trap. It is supported inside of a large oven, which is arranged with electric heaters for heating the tube during the first stage of the exhaust, and so constructed as to provide ample X-ray protection for the operators.

The first operation in the exhaust consists of heating the tube to about 400 deg. C. for three-quarters of an hour. This heating removes water-vapor, carbon dioxide and other gases from the glass and metal parts. After cooling, the tube is connected to an X-ray machine and operated as an X-ray tube. For the early stages of the exhaust, a machine is used which is so arranged that it operates automatically, passing just enough current through the tube to drive out the gas at the rate at which it can be removed by the exhaust system. The final stages are carried out on a regular interrupterless machine, and the operation has to be very carefully regulated by trained operators. As the vacuum improves, the potential applied to the tube is constantly raised. The operation is continued until all signs of gas, that is, appreciable green fluorescence in the bulb, have disappeared and the tube is backing up a 10-inch parallel spark gap and the anode is at an intense white heat. The whole operation requires about one and a half to two hours' time.

The foregoing description applies to the exhaust of the universal type of tube. The anode in the radiator type of tube cannot be heated as hot because of the low melting point of copper. The exhaust is carried out with the tubes connected to high tension transformers without mechanical rectifiers and requires a considerably longer time than the universal type. For many of these details the author is indebted to Messrs. R. C. Robinson and C. N. Moore of the Research Laboratory, General Electric Company.

The Trend of Motor Truck Design for 1921

(*Continued from page 31*)

shell. This type is considered better adapted for truck use than the cellular or honeycomb radiator because it will resist vibratory stresses better on account of its greater simplicity and strength due to the smaller number of parts used in its construction. Great improvements have been made in cellular radiator construction and also in providing spring supports for radiators of this type so that many

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makers continue to install the more efficient and lighter honeycomb coolers.

Despite the agitation that has taken place in the past several years on account of the shortage of motor fuel and the recommendations made by oil producers and automotive engineers that more attention be paid to engine design in order to use kerosene, practically all truck engines are designed to use gasoline as fuel instead of the more plentiful oils of less volatility such as distillate and kerosene. The double jet and compensating compound-nozzle types of carburetors are gaining ground rapidly, most designers favoring these forms above the old spring-controlled auxiliary-air-valve type of a few years ago. In order to take care of the lower grade fuel now generally sold, motor-truck engine-designers are taking the same precautions in regard to "hot spot" and heated manifolds to insure vaporization as are taken by designers of passenger-car engines.

A gain in electric starting and lighting systems is noted only on the "speed wagon" types which are modified from passenger car practice. There have been a few cases where electric starting and lighting have been included as standard equipment on the heavier models but in most cases designers have not deemed it necessary to supply either electric lighting or the self-starting feature on the heavier or large capacity trucks, though provision is made on many designs so it can be fitted as optional equipment with an additional charge should operating conditions make it desirable for the truck to be so equipped.

Many truck designers, especially those who have developed new types of power plants for their latest models, are favoring the unit-power-plant idea, in which the clutch and change-speed gearing are attached to the motor to form a unit that is easily installed and that is much more compact than the old truck construction where the engine and clutch were one unit and the change-speed gear was another, usually placed at a central point in the frame. When the unit-power-plan-idea is employed, in order not to have an excessively long propeller shaft with the attendant dangers of "whipping" and vibration, it is now considered good practice to install a brake drum member at a central point of the frame. This is carried by special bearings and serves as a tieup between a propeller shaft extending from the rear of the unit power-plant and one extending from the rear axle.

The multiple-disk clutch using asbestos friction-material-faced disks is by far the most popular in modern truck practice. Next in popularity, we have the three-plate clutch; the cone clutch, which was formerly used in fairly large numbers is now found on relatively few truck models. While the cone clutch is very simple and if properly designed, reasonably reliable, it is not a form that can be slipped very much without danger of burning the friction facing. It is also apt to be harsh in engagement so the multiple-disk and three-plate types have been found to be the most practical and reliable for heavy-duty truck service.

The three-speed selective sliding gear-set is the most peculiar type in trucks up to 3,000 pounds capacity, there being very few light trucks equipped with four-speed gears. Even in the 4,000-pound class the three-speed gear still leads but the four-speed begins to receive increased application until in trucks of 5,000 pounds and over we find more four-speed gear-sets than three-speed. Most truck makers continue to fit a power take-off only at extra cost.

One of the points in connection with motor-truck design that has caused considerable controversy in the past is the best method of final drive. At the present time this point seems to be fairly well settled as shaft drive is generally used, there being only twenty models, of the 682 reviewed, that were equipped with

chain drive. In spite of the fact that chain drive is the most efficient and will transmit a larger proportion of the engine power to the truck driving-wheels than any other, most truck designers favor some form of rear axle that permits a shaft-drive system and enclosed gearing to be installed. The majority of truck designers apparently favor worm drive as 446 out of 682 models are equipped with axles of this form.

The protagonists of the double-reduction axle-form favor that type in which there is a primary reduction by means of bevel gearing and a secondary reduction by means of small spur-pinions at the end of the live-axle shaft which mesh with internal spur-gears driving each rear wheel. There are in all 162 models provided with internal-gear-and-double-reduction-drive axles. The larger number of internal-gear-drive axles are used in trucks rated at 4,000 pounds or less though models are found equipped with this drive even in the 10,000-pound class and the fact that there are no structural reasons for limiting its use is attested by the successful application of an internal-drive axle on at least one 7-ton model.

The Hotchkiss drive-system predominates in all trucks below and including the 6,000 pound classification. For example, in the 5,000 pounds class the proportion is about two to one, there being twice as many Hotchkiss drive systems as all other types combined. In the classifications between 3 and 5 tons capacity there are about as many trucks using the Hotchkiss drive as there are forms employing radius rods to relieve the springs of driving and brake torque-reaction stresses. The radius-rod construction predominates in truck models of over 5-ton capacity. In spite of the advances that have been made in the construction of so-called positive-drive differentials, that form of differential mechanism employing bevel gears and pinions is still the most popular. The worm-type differential mechanism is a fairly close second in truck designer's esteem but the spur-gear type is a very poor third choice.

Practically all truck models are driven by the two rear wheels, of the number checked only twelve being found that followed the four-wheel-drive principle. The road clearance on most trucks varies between eleven and twelve inches though in side chain-drive models it may be as high as fifteen inches. Expanding brakes predominate because worm-drive axles are the most popular and most of these have expanding-shoe brakes housed in the wheel drums. Contracting brakes are also very popular, especially for hand-lever actuation when they are mounted on the gear box of the unit power-plant, as is common practice on many trucks under the 3,000-pound load-rating. Designers of trucks having long wheel-base are favoring special contracting-shoe brakes of large diameter which are mounted at a central point on the frame and which serve as a connecting member between shafts from the engine at the front end of the frame and the live axle at the rear end of the frame.

The driver's position is now at the left side on practically all trucks, only 12 models being listed in which there is a right-hand location for the driver's seat. Most truck models are now provided with a cab which may be completely enclosed by means of storm curtains for protecting the driver and his helper during inclement weather. This cab is usually built independent of the body and forms a part of the chassis. It is so designed that any type of body may be used without interfering with or calling for the removal of the cab.

The worm-and-nut steering-gear seems to be the most popular and in the writer's opinion it is an ideal truck type on account of the ease of operation and the low reduction possible. Owing to the slower speed of motor trucks large hand-wheels can be used, and two complete revolutions of the hand wheel are permissible to bring the wheels from one extreme angular position assumed in steering to the other.

There is one point that is apparent to all who are following motor-truck development and that is the big increase in the popularity of large pneumatic tires, which are now installed on even very heavy trucks and which seem to be giving good service as regards long life and reliability. These tires, which are of the cord type and provided with anti-skid treads of substantial proportions, are made in sizes up to 44 inches x 10 inches in reasonably large quantities and are found in some special cases of even greater diameter and in 12-inch widths. As will be apparent, extremely large casings of these sizes are not handled very easily and in case of a puncture, which rarely occurs, it is somewhat of a job to change them on the road. Special applying machinery has been developed for garage use but this is much too bulky for general service so it is customary practice to carry fully inflated tires mounted on demountable rims and provide metal wheels of special construction so the damaged casing may be removed with reasonable celerity and the inflated spare put on in its place. The advantages of these large tires have been previously considered in these columns so that it is not necessary to review them at the present time.

Something for Nothing

(Continued from page 32)

The Reclamation Act became a law of the land in June, 1902. It was a pet project of the late Theodore Roosevelt and was at that time strongly endorsed by the Republican party then in power. Since that time changing political complexions have not interfered with the act and under the Democratic administration reclamation was continued.

During the war, reclamation like many other domestic problems was more or less relegated to the background. But there is no reason which will bear examination why it should continue there. The platform promises are specific, if vague in their terms. Yet the American people know from sad experience that platform planks are all too easily splintered when occupied by their makers. It is for us all to see that these promises are not forgotten when a new administration comes into being, and that the work be not starved for lack of an addition to the fund, which will enable work at present unfinished to be expedited and work which should long ago have been begun to come into being.

We have grown so accustomed to thinking in terms of billions that the work which can be done with a hundred million dollars bulks small in our minds. Yet the concrete result of the reclamation projects are enormous. There are, for instance, more than 11,000 miles of canal in use, more than 1,600 miles of ditches and drains, 95 tunnels with an aggregate length of 144,847 feet, more than 13 million cubic yards in storage and division dams, half a million feet of dykes and levees, 7,293 bridges, 9,400 culverts, something less than three million feet of pipe, almost 700,000 feet of flumes, 1,450 buildings constructed and used by the service, 499 wells, almost a thousand miles of roads, eighty-three miles of railroads, 3,145 miles of telephone line, 650 miles of electric power transmission on line, and water steam developed to 60,375 horsepower. In the mere physical plant alone, then, it is evident that we haven't spent a hundred and twenty-three millions of dollars without getting something for it, and that our investment is safeguarded by actual property created, quite apart from the value given to the land irrigated by the operation of that created property.

So far, twenty-seven projects have been approved for construction and nineteen have been wholly or partially completed. But note that no new project can be undertaken unless the money to pay for it is in hand or in sight. *Before reclamation can be extended, payment for existing projects built must be made by those who are benefiting under them.*

When reclamation was new and untried, as large a fund as has been spent seemed more than ample. But reclamation is no longer an experiment. It makes crops grow in profusion where formerly man could not live. One has only to look at the pictures here shown to see by more convincing exhibits than mere figures the magic wrought in the desert by water. Reclamation brings good homes to the homeless. It provides paying work for the workless. It makes towns and cities grow where none were before. It conveys income into the treasury by producing taxable property where before was but a waste desert. It makes crops grow where no crops ever grew, thus adding to the total food available for the country—and the more food there is the less expensive it is. It brings into existence, as a pure by-product, power which before did not exist; note that the water used for power purposes is every drop available for irrigation, since what is taken from it in the development of power is energy not moisture. Reclamation beckons the farmer from the unproductive farm to a productive one. It calls to the city-bound boy to come back to the land where he can be certain of crops because certain of his water.

Is not this, then, a matter which calls not for a careless "let it alone" policy of government, but for an expanding support which will keep the work up to present day demands? Why wait five, ten, fifteen years to finish existing projects, or commence new ones, merely to comply with the law as it is today? Why not change the law and add to the fund? For what have we developed engineering principles in dam building, surveying, irrigation such as the world never knew before? To what end do our engineers, our scientists and our mathematicians lead the world in all that pertains to making great lakes of water where water never was, in all that has to do with producing power where no power is, in all that concerns making a garden of a desert, if we are to hold them down to the purely political question of a revolving fund which must turn its slow revolution through the years before we develop that which nature gave us to have and to hold? Legislators and politicians who say they are sincerely interested in governmental efforts to reduce the high cost of living should have a hard time explaining to the people of the United States why they do not increase the reclamation fund.

Leather Waste for Heels in Germany

COMMERCIAL men who are interested in the laether trade are bringing out of Germany samples of a sole leather made from waste leather which is suitable for the manufacture of heels for shoes of all kinds. The samples produced show a very firm, hard sole leather at first appearance suitable for any purpose for which sole leather is required. It is found upon close examination, however, that the leather is made up of pieces of waste leather which are likely to come apart when wet. The leather is manufactured from waste and scrap leather from old shoes or any other kind of leather waste, and is cleaned and soaked in water and then rolled into sheets and subjected to high pressure. The product has the appearance of a hard, dry, closely pressed sole leather, and for all purposes in shoemaking, when it can be protected to some extent from soaking, or can be fastened together as in the nailing of a heel, it gives promise of being useful and economical. The leather can be had at the present time at 17 German marks per kilo, which at present exchange figures out roughly at about 12½ cents gold per pound.

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THE extraordinary power of Pierce-Arrow Trucks is due to the Dual Valve Engine.

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It will pull out of holes, up grades, through sand and over rough going—saving money, saving time, saving labor and reducing strains and repairs and time spent in the shop.

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Economy in motor truck operation is found in low operating and maintenance cost; in trucks that are "on the job" day after day, and which are able to carry their loads over even bad roads.

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